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Preference Analysis for Fresh Pork by Asian Origin Consumers in North America

By

Murad Ali Khan

A Thesis submitted to the faculty of graduate studies and research in partial fulfillment of the requirement for the degree of Master of Science

In

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled PREFERENCE ANALYSIS FOR FRESH PORK BY ASIAN ORIGIN CONSUMERS IN NORTH AMERICA Submitted by MURAD ALI KHAN in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in AGRICULTURAL AND RESOURCE ECONOMICS.

DEDICATION

Dedicated to my late father Fazal Ali Khan

Abstract

As ethnic mix in North America is changing, there is need for a better understanding of effects of the ethnic diversity on food demand. This thesis examines Asian-origin consumer preferences for pork in North America. A binary choice model using Canadian data suggest that Asians have higher probability of purchasing pork and some of the selected pork cuts compared to Canadian born. The effect of other socioeconomic variables is also discussed. Data collected from Asian-origin consumers in San Francisco, California is used to examine preference rankings of thirteen attributes of fresh pork. Freshness is ranked as the most important attribute, followed by the attributes of the color of meat, lowness in fat, and the whiteness of fat. Empirical results from the postulated statistical model suggested that Asian-origin consumers should not be treated as a single homogenous niche group in marketing, since there are identifiable sub-groups of these consumers with specific attitudes and preferences.

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At the end, I am thankful to my mother and my elder brothers Fayaz, Nawaz and Riaz. Their constant prayers, inexhaustible efforts and financial support-throughout my life-made it possible for me to graduate from a prestigious institute like the University of Alberta.

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Chapter 1
Introduction

Background

For the last 30 years ethnic mix in North America has been changing and Asians are emerging as a significant ethnic group (Statistics Canada 1996, U.S. Census Bureau 1997). Of the 1 million immigrants that arrived in Canada between 1991 and 1996, 57% were of Asian origin, which is about 28 times higher than that before 1962 (Statistics Canada 1996). The 1996 census data shows that more than 2 million of the total population in Canada is of Asian origin (Table 1.1). Similarly, Asians and Pacific Islanders have the highest population growth rates in the United States (U.S. Census Bureau 1998). In March 1999 the Asian and Pacific population in United States reached 10.9 million, constituting 4 percent of the total population (Humes and McKinnon 2000). As people tend to bring their food habits along when they migrate, ethnic composition may have considerable impact on the food demand in North America. As food preferences of these ethnic groups are less well known to food producers, processors and distributors, there is a need for a better understanding of effects of the ethnic diversity on food demand in North America.

Ethnicity, Pork and Marketing

'Subculture' (a group whose members share beliefs and common experiences that set them apart from other members of a culture) is widely used by marketers as a segmentation variable (Solomon et. al. 1999). There are many subcultures and ethnic subculture is one of them. Ethnic subculture consists of self-perpetuating group of consumers who are held together by common cultural and/or genetic ties, which is identified both by its members and by others as a distinguishable category (Solomon et. al. 1999). Ethnic identity is often a significant component of consumer's self-concept (Solomon et. al. 1999). Consequently, this can have an impact on the decision of 'where to shop' and 'what to purchase'. Researchers have found that there were specific types of

consumer behavior that could not be explained by socioeconomic status (as indicated by income, occupation and education), suggesting that it is important to consider cultural or ethnic factors in marketing studies (Solomon et al. 1999). To be effective marketers, firms must devise strategies to meet the needs of ethnic groups' subcultures. Some Canadian companies have ethnic marketing programs. For example, BC Tel and Bell Canada are targeting the 600,000 Chinese Canadian who live in British Columbia and Ontario with a Chinese long-distance calling card (Solomon et al. 1999).

With recent hog expansion in Western Canada, Canadian pork producers are interested in new markets for their fresh pork products. One of such potential markets is the western United States of America. Kuperis *et. al.* (1997) conducted a study of market potential for Canadian pork exports in northwestern parts of the United States. They pointed out the need for further exploration of Asian ethnic pork markets in the United States. For many Asians, particularly Chinese-origin, pork is one of the traditional foods and preferred meat. For example, although per capita income in Mainland China is much lower than that in North America, people in China ate the same amount of pork in 1999 as compared to their counterparts in North America (USDA 2000). In Hong Kong and Taiwan, where per capita income is comparatively higher, per capita income is much higher than Canada and United States. The food expenditure survey results in 1996 shows that at-home per capita pork consumption by Asians is much higher than native Canadians (Statistics Canada 1996). The demand for pork can be therefore expected to increase with the increase in Asians in Canada or the United States.

In her study of pork market in San Francisco, Le (1999) observed that more than half of Asian-origin consumers purchased their fresh pork in Asian stores. Compared to conventional supermarkets, these Asian stores are very different in their approach of selling their pork products and carry different variety of pork cuts or parts. Are Asian origin consumers different from general population? Would a unique strategy be necessary to market pork to this ethnic group? What basis should marketers rely on to form such strategy? There have been few studies of the food behavior of Asian groups in

North America (Kuperis et al. 1997, Park et al. 1997). Without that type of information, it is difficult to plan informative strategies to reach this promising market.

Objectives of the Thesis

The overall objective of this thesis is to gain a better understanding of Asian-origin consumer preferences for fresh pork in North America. The three specific objectives are:

1. To investigate whether or not Asian-origin consumers are different from general population in pork consumption;
2. To identify what are the pork attributes that are valued most by Asian-origin consumers and why;
3. To develop marketing implications based on the information gathered in 1) and 2).

Method of Analysis

To achieve the above objectives, two types of data are used. One set of the data is obtained from Canadian Family Food Expenditure Survey (FFES) 1992 (Statistics Canada 1992). The second data used in the study are from a survey conducted by Theresa Le, (Le 1999).

To examine whether or not Asian-origin consumers are different from the general population, we look at factors that influence consumer pork purchasing decision. Due to the dichotomous nature of the purchase decision, qualitative response models such as logit and probit models are appropriate. As both logit and probit models yields nearly similar results, a binomial probit model (Mandala 1981) was employed to the Canadian Family Food Expenditure Survey data to see the effects of socioeconomic and demographic variables on the consumer purchase decision of pork and pork products.

Self-explication approach (Green and Srinivasan 1990) is adopted to elicit consumers' perception of pork attributes using Le's (1999) data. The nature of the self-explication procedure is that respondents were first asked to evaluate the importance level (rating) of pork attributes and then asked to allocate a specific number of points across the attributes to reflect their relative importance (ranking). The respondents' part-worth (as a measure of overall importance) is obtained by multiplying the rating for each attribute and the relative ranking of each attribute (Green and Srinivasan 1990). Kruskal-Wallis test is used to see whether the selected attributes are different from one another. If Kruskal-Wallis test reveal that selected attributes are different from one another, the next step is to simultaneously compare all the possible pairs of attributes to determine which attribute is more important. Multiple comparison tests (Berenson and Levine, 1996) are used for the purpose.

To identify the determinants of Asian consumer importance rankings of pork attributes, ordered probit models (Greene 1997) are used. Separate models are estimated for each selected fresh pork attribute with specified socioeconomic and demographic characteristics.

Organisation of the Thesis

Chapter two focuses on analysis of Canadian consumers characteristics associated with the selection of pork products. This chapter evaluates ethnic variables to see whether Asians consumers differ significantly in consumption of pork products from other consumers in Canada. The chapter is based on the Canadian Family Food Expenditure survey 1992 (Statistics Canada 1992). A binary probit model (Greene 1997) is used to find the relations between the regressents and regressors, if any. Chapter 3 examines how Asian consumers in San Francisco, California rank selected attributes of fresh pork. Chapter 4 outlines conclusions, implications and the future research possibilities in this research area.

Table 1.1. Population by ethnic origin in Canada, 1996 Census.

Definitions and notes	Number
Total population	28,528,125
Multiple origins*	10,224,500
Single origins	18,303,625
British Isles origins	3,267,520
French origins	2,683,840
European origins	3,742,890
Asian origins	2,156,900
African origins	137,315
Pacific Islands origins	5,765
Latin, Central and South American origins	118,640
Caribbean origins	305,290
Aboriginal origins	477,630
Canadian origins	5,326,995
Other origins	80,840

Source: Statistics Canada, 1996 Census.

* Parents of the respondents are not of single origin.

Chapter 2

Effect of Asian-Origin Ethnicity on Pork Consumption: Evidence from the Canadian Family Food Expenditure Survey

Introduction

Canada is a nation of immigrants. With the exception of its aboriginal peoples, Canada's history is based on immigration from other countries. In 1962, Canada's immigration laws were changed (Satzewich 1992) and in 1992 a new immigration framework was introduced to set out a target level of 250,000 immigrants per year until 1995 (Citizenship and Immigration Canada 1991). These changes led to an influx of immigrants from all over the world, replacing the earlier traditional source of European immigrants. Asia is emerging as the key source of immigrants as a result of this multicultural influx. This changing ethnic mix is also affecting the demand for food in Canada. Therefore, there is a need for research on any ethnic communities that are fast-growing, large enough to be viable, and whose food demands are potentially less well-known to food producers, processors, and distributors in Canada. Declining red meat consumption, rising health and nutrition consciousness, and increasing competition in food marketing reinforce the need for a better understanding of consumer concerns for successful meat marketing.

Food has been identified as one of the most visible and relevant components when defining a society's collective culture (Anderson 1979). Research shows that food consumption is strongly linked with ethnic identity (Goodwin and Koudele 1990, Park and Capps 1997, Nayga 1995). Food consumption patterns of Asian-origin consumers in Canada are found to be different from other immigrants (Redmond and Sundue 1994). Not only do Asian immigrants buy their groceries from different stores, but they also buy a different mix of foods. Thus, it has been suggested by some studies that Asians could be treated as an identifiable sub-group of food consumers or as a possible niche market for food products in Canada. For example, Redmond and Sundue (1994) suggested that an increasing number of Asians in Canada would increase the demand for pork and chicken relative to other foods such as fluid milk.

Cross-cultural studies have shown that Asian immigrants are more likely to retain a stronger ethnic identity than European immigrants (Deshpande 1986, Hoyer and Donthu 1986). However, several studies suggested that years of immigration do affect food consumption patterns despite strong ethnic identities (Chen 2000, Capps et al. 1988). Chen (2000) suggested that an immigrant's arrival year has a significant and positive affect on consumption of food away from home. Ethnicity and the number of immigration years are of interest to assess as factors in determining food demand.

This chapter assesses the effects of socioeconomic and demographic variables on consumption of pork and its different cuts, in Canada. It focuses on the effect of ethnic origin and immigration years on pork and parts of pork purchase. The emphasis is placed on whether or not Asian consumers could be treated as a niche market for pork i.e. whether they have different pork consumption preferences compare to other ethnic groups.

The chapter is based on the Canadian Family Food Expenditure Survey (FFES) in 1992. A binomial probit model is used to examine the effect of socioeconomic and demographic variables on the consumers with regards to their at-home consumption of pork and parts of pork.

Pork Consumption by Asian and Asian-Origin Consumers

Ethnic identity is often a significant component of consumer's self-concept (Solomon et. al. 1999). Consequently, it has an impact on the consumer's decision of 'where to shop' and 'what and how much to purchase'. Kuperis *et. al.* (1997) conducted a study of market potential for Alberta pork in Vancouver, Seattle, and Portland. They pointed out the need for further exploration of Asian ethnic pork markets in these markets.

For many Asians, pork is one of the traditional foods and a preferred meat. For example, per capita pork consumption in the Mainland China is comparable to that of Canadians even though per capita income is much lower in China. In Hong Kong and Taiwan, where per capita income is higher compared to the Mainland China (or comparable to Canada and the United States), per capita pork consumption is much higher than that in North America. For example, in 1998, each person in Hong Kong and Taiwan consumed 23.5 Kg and 12.8 Kg more pork than Canadians, respectively (Table 2.1). As a result, the demand for pork can be expected to rise with the increase in Asians in Canada or the United States.

The Canadian family food expenditure survey (FFES) in 1992 divides the respondents into four main categories on the basis of country of birth of the respondents (Table 2.12). These categories are: respondents born in Canada (Canadian), respondent born Britain, USA, north and west Europe (USNWEURP), respondents born in south and east Europe (SEEUROPE), respondent born in China, Asian and Oceania (ASIANS) and other and not stated (OTHERS). FFES survey result in 1992 shows that at-home per capita pork consumption by Asian-origin respondents (ASIANS) is much higher than that of native Canadians (Table 2.3). There are about 14% more Asian households who purchase pork as compared to Canadian-born while compare to other immigrants about 16% more household purchase pork. The percentage of Asian households purchasing legs, loins, bellies, shoulders, hocks and offal (from all mammals) is also higher compared to both Canadian-born and other immigrants. Asian households purchasing pork, legs, loins, bellies, shoulders, hocks, and offal are 14.01%, 0.92%, 13.30%, 9.62%, 6.09%, 11.33%, and 12.07% higher respectively, as compare to Canadian average. As compared to other immigrants Asian households purchasing pork, legs, loins bellies, shoulders, hocks, and offal are 15.76%, 0.93%, 15.33%, 9.27%, 6.51%, 10.84%, and 8.83% higher respectively. Asian households are therefore, more likely to purchase pork and its parts, as compared to Canadians and other immigrants.

These preliminary results provide some evidence that Asian-origin consumers appear to be different from others in terms of purchasing pork. To analyze the effects of

various other variables on the pork-purchasing decision of consumers, an empirical model is designed based on the FFES of Canada.

Empirical Model

The goal of this analysis is to determine the effects of various exogenous factors on the decision of the consumer to purchase a given variety of pork. Given the dichotomous nature of the consumer, a qualitative response model is appropriate. Qualitative response models relate the probability of an event to various independent variables. Such models are often useful when assessing consumer characteristics that are associated with purchasing decisions (Capps *et al.* 1985). Three alternative qualitative response models, commonly used in an empirical analysis of discrete choice are: the linear probability model, the logit model, and the probit model. Econometric problems associated with linear probability models are well recognized[1] (Amemiya 1981) and necessarily limits this model's suitability for empirical work.

On the other hand, the probit model is particularly suited to cases where a dichotomous intention-to-buy is used as the dependent variable (Rao and Winter 1977). The estimation procedure, however, cannot guarantee maximum global likelihood estimates. The probabilistic choice models such as logit and probit assume that paired comparisons are probabilistically independent. If the dependent variable data is obtained directly as paired comparisons, this may be a realistic assumption. However, this method is an inefficient way of collecting data (and is not even applicable to our data). If the data is obtained as a rank order and then converted to the equivalent $n(n-1)/2$ paired comparisons, this assumption is simply not realistic[2]. As well, the asymptotic estimates of standard errors are not likely to be valid either. (In any event the limited number of stimuli usually used in consumer-research studies casts doubt on the appropriateness of

[1] The linear probability model suffers from heteroskedasticity, from nonnormal residual error, and from the fact that the predicted values of the dichotomous dependent variable are not required to lie between 0 and 1.
[2] However, Punj and Saelin (1978) utilize a procedure based only on the n-1 *independent* choices that mitigates this problem.

such asymptotic statistics.) Despite these limitations, however, the probabilistic choice models appear to have substantial predictive validity (Green *et al.* 1978).

Although there are subtle differences, the probit and logit specifications usually yield nearly identical results and thus it becomes difficult to distinguish them from one another statistically (Capps and Kramer 1985, Amemiya 1981). Given this apparent equivalence, the probit specification was arbitrarily chosen for the empirical analysis undertaken here.

A dichotomous random variable, y_i for which $y_i = 1$ if consumer i purchases pork or a part of pork and $y_i = 0$ if otherwise, is defined. Assume that the probability of purchasing pork or its parts depends on a vector of independent variables associated with consumer i, X_i, and a vector of unknown parameters β, so that

$$\text{Prob}(Y = 1) = F(\beta' x) \tag{2.1}$$

$$\text{Prob}(Y = 0) = 1 - F(\beta' x) \tag{2.2}$$

For the probit model the probability of purchasing pork or its parts is determined by

$$\begin{aligned} \Pr ob(Y = 1) &= \int_{-\infty}^{\beta' X} \phi(t)dt \\ &= \Phi(\beta' X) \end{aligned} \tag{2.3}$$

where ϕ is standard normal probability density function, t is standard normal random variable, and $\Phi(\cdot)$ is the standard normal commutative distribution function (Greene 1997).

The purchase of pork parts varieties was hypothesized to depend upon a variety of demographic as well as socioeconomic factors. The statistical model used for $X_i\beta$ above, to evaluate a consumer's purchase decision regarding variety of pork parts, is given by

$$y^* = \beta' x + \varepsilon \tag{2.4}$$

$$y = 1, \text{ if } y^* > 0 \text{ and}$$

$$y = 0, \text{ if } y^* \leq 0$$

where y* is unobserved dependent variable, $\beta' x$ is called index function, ε is random error and y is observed dependent variable (Greene 1997).

Varieties of meats are often considered to be "ethnic foods" (Goodwin and Koudele 1990). In this light, an individual's ethnic heritage may be an important factor in influencing his or her decision of whether or not to purchase a variety of meats. Variables that attempt to capture this effect will be included in the probit model. The demand for pork may vary around the year from season to season. An examination of the effects of the changing seasons on the demand for fresh pork variables - which may capture the seasonal affects - will also be included in the model.

In order to see whether the purchasing of pork varies from province to province and rural to urban areas, variables, which can capture these effects, will also be included in the model. Consumption of pork might also depend upon tradition or other cultural influences associated with age. Data on both American per capita meat consumption and the red meat consumption share of variety meats (American Meat Institute, Meat Facts 1987 edition) have shown steady declines in both. In other words red meat and variety of meat consumption have declined in the new generation. In this light, older consumers may show stronger preferences for consuming a variety of pork products. Therefore, variables representing the age of the respondents will also be included in the model.

Whether the consumer is male or female may also have an influence on their decision to purchase pork. Because of traditional sociological norms, female consumers may possess a greater knowledge of the nutritional characteristics of variety of meats as well as greater expertise in the preparation of such specialty products. Similarly, a consumer's educational level might also have a significant influence on the likelihood of his or her purchasing a variety of pork products. Higher levels of educational attainment might imply an enlightened and more receptive attitude toward unusual foods on the part of consumers. It has been noted that a positive association exists between education and the nutritional consciousness of the consumer in question (Redman 1980). A well-educated consumer might also be more cognizant of variety meats. It is possible that

educational attainment is highly correlated with other, omitted, socioeconomic variables that influence the consumption of variety meats. With all this in mind, the variables of gender and level of education of the respondent will therefore be included in the model.

A large household size may also have a significant influence on the variety of meats purchased due to the greater financial burden of feeding larger families. In light of the time-intensive nature of preparing a variety of meat products, larger households may also hold an advantage in terms of a greater supply of household labor. Therefore, variables related to household size will also be included in the model.

Some parts of pork are generally less expensive in terms of price per pound than choice pork products, a result of the fact that edible offal is considered to be a by-product of the overall meat complex. In this light, differences in the probability of purchasing different parts of pork may exist across different income groups. In particular, low-income households may be more likely to purchase a variety of meats than high-income households. In addition, the preparation of some parts of pork (offal for example) may be rather time-intensive relative to other pork products. In this light, households with higher incomes may prefer more convenient pork alternatives because of the higher opportunity costs associated with preparing a variety of pork products. On this note, variables representing the income level of the respondent will also be included in the model.

Even though the dependent variable is whether or not to purchase pork, in order to see if there is a relation between pork parts and independent variables, different parts of pork are considered as dependent variables as well.

Data Description

The Canadian Family Food Expenditure Survey of 1992 is used for this study. Although a later version of the data is also available, 1992 data was used because this year included the important variable of Immigration Years, which was not present in the 1996 survey. 'Family Expenditure Surveys Section, Household Surveys Division,

Statistics Canada' collected the Family Food Expenditure Survey of 1992. The survey was carried out throughout that year and was designed to provide information for persons living in private households in the 10 provinces of Canada, as well as Whitehorse and Yellowknife. Records from Whitehorse and Yellowknife were excluded from the data.

An important variable in the data being studied is country of birth. This divides the data into five groups: 1) Canada; 2) Britain, the United States, Northern and Western Europe; 3) Southern and Eastern Europe; 4) China, Asia, and Oceania; 5) Other and Not Stated. It is important to note that Canadian-born may also include Canadian-born Asians and other Canadian-born minorities. Moreover, the variable of Asian in this study is based on (4), which not only includes Asian countries but also includes other countries in the Oceania (Table 2.12). However, Canadian statistics show that the number of immigrants from the Oceania is quite small when compared to Asians (Statistics Canada). The variable (4) was used to proxy Asians in the study.

This survey generated two data files: a 'summary file' and a 'detailed item file'. The summary file contains a household description as well as income and summary expenditure information. There is one record for each weekly diary reported, with a maximum of two per household. This data file has 21,520 observations in ascending order and 118 variables, with two observations (for two weeks) for most of the households. The total number of households in the survey is 10,848, which can be obtained by aggregating weeks for each household in the summary.

The 'detailed item file' set records for the items purchased i.e. our dependent variables. The total number of purchases of an item by a household over a week in a certain type of store constitutes one record. If a household made no purchases of an item, no record will be present for that item. This data file includes 914,852 observations and seven variables.

The data for this study were obtained by combining the required information from both files. Using the data-analyzing software SPSS, weeks in the summary file were first

aggregated so that each household was represented once in the data. The size of the summary file is now 10,848 instead of 21,520.

Using the detailed item file, data for each dependent variable were extracted separately using 'detailed food codes' of dependent variables. All these files were saved separately and were merged to obtain the 'detailed item file with dependent variables only'. This file was finally combined with the aggregated summary file to obtain the desired data form. However, this file had missing values for households not consuming pork or offal. Missing values of offal and pork were replaced with zeros and others who did consume pork or offal were replaced with one to generate a qualitative variable for each dependent variable. The number of households in this file, represented by a single observation or record, was 10,848. Households with zero or negative incomes were deleted, leaving the sample size at 10,657. Limdep (7.0) and SPSS (9.0) were used to create new variables (or re-code existing variables) based on the same data, but not given directly in the data. Most of these variables are explained in Table 2.2. To see the effect of the immigration years and ethnicity together, four dummy variables were created as a product of country of birth and immigration years. These variables are IMASIAN, IMYUSNWE, IMYSEE and IMYOTHER (Table 2.2). Square of variables age (AGE), household size (HSIZE) and income (INCOME) i.e. SQAGE, SQHSIZE and SQINCOME respectively were created and added to the model. Derived variables along with other variables are given in Table 2.2 and descriptive statistics of the survey are presented in Table 2.4.

Estimation and Results

The probit model as in equation (2.4) is estimated by the methods of maximum likelihood. Maximum likelihood estimates are calculated using a probability density function. For the random variable $Y \sim N(\beta, \sigma^2)$, probability density function is given by

$$f(y) = (2\pi)^{-1/2}(\sigma^2)^{-1/2} \exp\left\{-\frac{y-\beta}{2\sigma^2}\right\} \qquad (2.5)$$

where y is the observed value of the independent random variable, β is the mean, and σ^2 is the variance of the random variable. For the T independent variables equation (2.5) can be written as

$$f(y_1,...,y_T \mid \beta,\sigma^2) = (2\pi)^{-T/2}(\sigma^2)^{-T/2} \exp\left\{-\sum_{i=1}^{T}\frac{(y_1 - y_2)}{2\sigma^2}\right\} \qquad (2.6)$$

The estimates of β and σ^2 that maximize the equation (2.6) are maximum likelihood estimates (Griffiths et al. 1993).

Equation 2.3 was estimated using the econometric software Limdep, Version 7.0. Parameter estimates and goodness of fit statistics are presented in Tables 2.5 to 2.11. The values of R-squares for the models are not high but reasonable enough for an analysis of cross-sectional data. The likelihood ratio test statistics also exceed the chi-square critical value (55.26), with 32 degrees of freedom at a 0.005 level of significance. This rejects the null hypothesis that all slope parameters are zero. Table 2.5b to 2.11b presents the predictions of success for the models. Except pork and loins all the models predicts more than 90% of the observations correctly. The percentage of right predictions is 63.70 and 70.86 for pork and loins respectively. These statistics indicate that the probit models are of significant value when explaining factors that influence the purchase of pork and its parts. In general, the parameter estimates are statistically significant for pork, as evidenced by the relatively large t-ratios. However, the significance of other parameter estimates varies across the different parts of pork, and offal.

These estimates from the probit model only indicate the direction of change in probability caused by a change in the independent variables. However, the parameter estimates do not directly represent the change in the probability of purchasing caused by a change in the independent variables. Such probability changes depend on the original probability and thus on the initial values of all independent variables and their coefficients (Judge et al. 1982). The regression for probit model can be given by:

$$\begin{aligned} E[y] &= 0[1 - F(\beta' x)] + 1[F(\beta' x)] \\ &= F(\beta' x) \end{aligned} \qquad (2.7)$$

Whatever distribution is used, it is important to note that the parameters of the model, like those of any nonlinear regression model, are not necessarily the marginal effects. In general,

$$\frac{\partial E[y]}{\partial x} = \left\{ \frac{dF(\beta' x)}{d(\beta' x)} \right\} \beta$$
$$= f(\beta' x)\beta, \qquad (2.8)$$

In most cases, the marginal probability brought about by independent variable x in the probit model is given by the above equation. The 'Marginals' in Tables 2.5a to 2.11a represents this probability. However, when independent variables are of a qualitative nature, as in the case of most of the explanatory variables utilized in this investigation, $\frac{\partial E[y]}{\partial x}$ does not exist. In other words, since x is a discrete variable it cannot vary continuously. In such cases, the probability change must be obtained by the evaluation of P (probability that y=1), at the alternative values of x. . Marginal effects for dummy variables are obtained through probability change by evaluating P (probability that y=1) at x=1 and P (probability that y=1) at x=0, while keeping the values in all other variables at their sample means. Probability that y=1 at x_i=1 while keeping all other variables at their sample means, is given by

Probability (that y=1) = Φ ($\beta_0 + \beta_1 x_1 ... + \beta_i x_i ... + \beta_n x_n$)

Or Probability (that y=1) = Φ ($\beta_0 + \beta_1 x_1 ... + \beta_{i-1} x_{i-1} + \beta_i + \beta_{i+1} x_{i+1} ... + \beta_n x_n$) (2.9)

and probability that y=1 at x_i=0 and all other variables are at their sample means, is given by

Probability (that y=1) = Φ ($\beta_0 + \beta_1 x_1 ... + \beta_i x_i ... + \beta_n x_n$)

Or Probability (that y=1) = Φ ($\beta_0 + \beta_1 x_1 ... + \beta_{i-1} x_{i-1} + \beta_{i+1} x_{i+1} ... + \beta_n x_n$) (2.10)

where

y=dependent variable,

x_i is independent variable,

β_i is co-efficient of x_i

$\Phi(\cdot)$ is standard normal cumulative distribution function

The change in probability is calculated as a difference between (2.9) and (2.10) and is represented by 'change in probability' in Tables 2.5a to 2.11a.

Heteroskedasticity

Analyses in this study are based on cross-sectional data, and the problem of heteroskedasticity arises primarily in cross-sectional data (Greene 1997). The importance of the homoskedasticity in probit models is stressed by Greene (1997): "If the disturbances in the underlying regression are heteroskedastic, the maximum likelihood estimators are inconsistent and the variance matrix is inappropriate. This finding is particularly troubling in the view that the probit model is most often used with microeconomics data, which is frequently heteroskedastic". The basic equation for heteroskedasticity is tested by allowing the standard deviation of the error to vary according to

$$\sigma_i = \sigma \exp(z'\gamma)$$

where z is a vector of variables that typically includes some of the x's and their powers, and γ is a vector of coefficients. In our case z includes the three variables age (AGE), household size (HSIZE), and income before tax (INCOMEBT). ML estimation of β and γ for the heteroskedastic probit model is estimated using Limdep version 7.0, permitting likelihood ratio (LR) testing of γ=0; a condition that corresponds to homoskedastic errors.

When a general equation of Table 2.5a was estimated with z defined to contain age, household size, and income, the restricted log of likelihood was (L_r) -6908.89. The unrestricted log of likelihood (L_u) was also the same. The likelihood ratio test for heteroskedasticity is given by

$$LR = 2[L_u - L_r]$$

with critical chi square $\chi^2(3) = 3.84$. As LRs for this and other specifications were almost zero, this suggested that the problem of heteroskedasticity did not exist in the models. The test was conducted for each equation given in table 2.5a to 2.11a but tables of these equation estimates were not reported, as the purpose of the estimation was to test for heteroskedasticity.

Marginal Effects

Using the econometric software Limdep, marginal effects were calculated for each variable while holding other variables constant at their sample mean values. As most of the explanatory variables are of a qualitative nature and cannot be explained by marginal effects (calculated by Limdep) therefore, marginal effects through changes in probabilities are also obtained for dummy variables using Excel as discussed under 'estimation and results'. Parameter estimates, marginal effects, change in probability, and other estimates for each model are presented in Tables 2.5 to 2.11. Continuos variables, immigration years, age, household size and income, are therefore interpreted using marginal probability estimates and all other (or dummy) variables were interpreted using change in probability estimates.

Ethnicity:

Ethnicity, especially 'Asians' is the most important explanatory variable and focus of this study. Parameter estimates of the probit models (Tables 2.5a to 2.11a) suggest that Asians are more likely to purchase more pork, loins, bellies, shoulders, hocks, and offal compared to people who are Canadian-born. Change in probability estimates suggests that the probability of purchasing pork by Asians is 0.1673 higher compared to Canadians (Table 2.5a). Also, Asians' probability of purchasing loins is 0.2151 higher, and the probability of their purchasing bellies is 0.1826 higher compared to Canadians (Tables 2.7a and 2.8a). The probabilities of purchasing shoulders, hocks,

and offal are 0.0593, 0.1973%, and 0.2203 higher respectively for Asians compared to Canadian-born (Tables 2.9a, 2.10a, and 2.11a).

People from the United States and Northwestern Europe are likely to purchase less pork, loins, and bellies compared to Canadian-born (Tables 2.5a, 2.7a, and 2.8a). The probability of pork purchasing by people from the United States and Northwestern Europe is 0.0949 lower compared to Canadian-born (Table 2.5a). People from South Eastern Europe are likely to purchase more pork, loins, bellies, hocks, and offal compared to Canadians, and their probability of purchasing pork is 0.1379 higher than Canadians in general (Tables 2.5a, 2.7a, 2.8a, 2.10a and 2.11a). People from categories other than the above are likely to purchase less pork compared to the Canadian-born (Table 2.5a).

Immigration years:

Compared to Canadian-born, an increase in immigration years or years of stay in Canada does not seem to have any significant effect on either pork or pork parts (except bellies) purchased by Asians (Tables 2.5a to 2.11a). Only increasing year of immigration has a negative effect on the purchase of bellies for Asians (Table 2.8a). The marginal probabilities suggests that with one unit increase (decrease) in immigration years, the probability of buying bellies by Asians decreases (increases) by 0.0151 (Table 2.8a).

An increase in the number of immigration years of people from the United States and Northwestern Europe seems to have a significant, positive effect on pork consumption (Table 2.5a). Compared to Canadian-born, these people are likely to purchase more pork, especially loins, with increasing years of immigration (Tables 2.5a and 2.7a). The probability of them purchasing pork increases (decreases) by 0.0163 and the probability of them purchasing loins increases (decreases) by 0.0134 with one unit increase (decrease) in immigration years (Tables 2.5a and 2.7a).

Compared to Canadian-born, an increase in immigration years of people from Southeastern Europe has a negative effect on their purchasing of pork, especially loins and offal, but has a positive effect on the purchase of shoulders (Tables 2.5a, 2.7a, 2.9a, and 2.11a). The probability of their purchasing pork decrease by 0.0228 compared to Canadian-born, with one unit increase in immigration (Table 2.5a). Compared to Canadian-born, the probability of people from Southeastern Europe buying loins decreases by 0.0369, the probability of them buying offal decreases by 0.0130, but the probability of them purchasing shoulders increases by 0.0081 with one unit increase in immigration years (Tables 2.7a, 2.9a, and 2.11a). Immigration years of other immigrants seem to have a negative effect on the purchase of offal (2.11a).

Seasonal Influence:

Tables 2.5a to 2.11a show the seasonal effect on the probability of purchasing pork. Table 2.5a shows that first quarter of the year has no significant effect on the overall purchase of pork compared to the fourth quarter, but it significantly affects the purchase of some parts of pork. The probability of legs, shoulders, and offal being purchased is higher in the first quarter, while the probability of hocks being purchased is lower compared to the fourth quarter of the year (Tables 2.6a, 2.9a, 2.10a, and 2.11a). The probability of purchasing shoulders is higher by 0.0135 in the first quarter compared to the fourth quarter.

There is no significant effect in the second quarter of the year on total pork purchases, when compared to the fourth quarter of the year (Table 2.5a). However, at this time the probability of purchasing legs is 0.0065 higher, and the probability of purchasing hocks is 0.0165 lower compared to the fourth quarter (Tables 2.6a and 2.10a). The probability of buying pork—especially hocks—decreases significantly in the third quarter of the year compared to the fourth quarter (Tables 2.5a and 2.10a). The probability of buying offal also decreases in the third quarter compared to the fourth quarter (Table 2.11a). Finally, the probability of buying pork is 0.0289 lower in the third quarter compared to the fourth quarter of the year (Table 2.5a).

Provinces:

The results show that respondents from Quebec are not significantly different from the Atlantic Provinces (or the dropped category) in terms of purchasing pork (Table 2.5a). (The category dropped due to a singularity problem includes Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick, and masked records). Respondents from Quebec significantly affect the consumption of some parts of pork. They are likely to purchase less loins, less bellies, less shoulders, but more hocks and more offal compared to the Atlantic Provinces (Tables 2.7a to 2.11a). In terms of probability, the probability of Quebec respondents purchasing bellies is 0.0267 lower, and the probability of their purchasing offal is 0.0313 higher compared to the Atlantic Provinces (Table 2.8a and 2.11a).

Compared to the Atlantic Provinces, respondents in Ontario are less likely to purchase pork, especially legs, loins, bellies, and shoulders but more hocks. Their probability of purchasing pork is 0.0306 lower, the probability of their purchasing legs is 0.0076 lower, the probability of purchasing loins is 0.0264 lower, and the probability of them purchasing shoulders is 0.0155 lower compared to the Atlantic Provinces. Their probability of purchasing hocks is, however, 0.0089 higher compared to the Atlantic Provinces.

Respondents from Manitoba are also less likely to consume pork compared to those in the Atlantic Provinces, and they are also less likely to consume loins and shoulders compared to respondents from the Atlantic Provinces. The probability of pork purchasing by people in Manitoba is 0.0787 lower than the Atlantic Provinces. The probability of them purchasing loins is 0.0715 lower and their probability of purchasing shoulders is 0.0192 lower compared to the Atlantic Provinces.

Respondents from Saskatchewan, Alberta, and British Columbia are also likely to consume less pork compared to the Atlantic Provinces. The probability of pork buying

by respondents from Alberta is 0.0808 lower, the probability of their buying legs is 0.0090 lower, the probability of them buying loins is 0.0675 lower, and their probability of buying shoulders is 0.0240 lower compared to persons from the Atlantic Provinces. The probabilities of persons from Saskatchewan and British Columbia buying pork are 0.0596 and 0.0395 lower respectively, when compared to the Atlantic Provinces.

City[3]*:*

Living in any of the 15 selected cities does not significantly affect the consumption of pork (Table 2.5a). However, persons living in the cities are less likely to consume shoulders compared to other respondents (Table 2.9a). The probability of a city respondent buying shoulders is 0.0067 lower compared to a person not residing in the city (Table 2.9a).

Age:

Age has a significantly positive effect on the consumption of pork and pork parts. With one unit increase in age, the marginal probability of buying pork increases by 0.0076 (Table 2.5a). With one unit increase in age, the probability of buying legs increases by 0.011 (Table 2.6a), the probability of buying loins increases by 0.0058 (Table 2.7a), the probability of buying bellies increases by 0.0019 (Table 2.8a), and the probability of buying shoulders increases by 0.0029 (Table 2.9a). Also at this point the probability of buying hocks increases by 0.0020 (Table 2.10a) and the probability of buying offal increases by 0.041 (Table 2.11a), with only one unit increase in age. The probability of purchasing pork and pork parts will, however, increase, but with a diminishing rate following increase in age, as suggested by the negative sign of the square of age (SQAGE).

[3] A person is considered to be living in a city if the person resides in one of the 15 selected cities, i.e. St. John's Halifax, Saint John, Quebec, Montreal, Ottawa, Toronto, Thunder Bay, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver, and Victoria.

Male:

Compared to females, males are less likely to purchase pork, especially offal (Tables 2.5a and 2.11a). The probability of a male purchasing pork is 0.0204 lower compared to females and the probability of buying offal is 0.0099 lower for males when compared to females (Table 2.11a). The probability of buying other parts of pork does not seem to be significantly affected by gender (Tables 2.6a to 2.10a).

University:

Respondents with a university level of education are less likely to purchase pork, especially loins and bellies, compared to those with other levels of education (Table 2.5a). The probability of a respondent with a university level of education buying pork is 0.0336 lower compared to all other respondents (Table 2.5a). The probability of someone buying loins and bellies is also lower, by 0.0372 and 0.0201 respectively, for respondents with a university level of education (Tables 2.7a and 2.8a).

Female Employment:

The estimated results suggest that a full-time employed female is not significantly different from another female either in purchase of pork or its parts (Tables 2.5a to 2.11a).

Household Size:

Compared to a one-person household, married couples are likely to purchase more pork, especially loins bellies, hocks, and offal (Tables 2.5a, 2.7a, 2.8a, 2.10a, and 2.11a). The probability of a married couple purchasing more pork is 0.1096 higher compared to a

single-person household (Table 2.5a). The probability of a married couple buying loins is 0.1145 higher (Table 2.7a) and the probability of them buying bellies is 0.0475 higher (Table 2.8a) when compared to a single-person household. Similarly, the probability of buying hocks is 0.0180 higher and the probability of buying offal is 0.0257 higher for a married couple compared to a single-person household (Tables 2.10a and 2.11a).

A household, with more than two persons, is also likely to purchase more pork compared to single-person household (Table 2.5a). Such a household is more likely to purchase loins and bellies compared to a single-person household (Tables 2.7a and 2.8a). The probability of pork buying increases by 0.1123 for such a household when compared to a single-person household (Table 2.5a). Their probability of buying loins is 0.1207 higher, and the probability of buying bellies is 0.0637 higher compare to a single-person household (Tables 2.7a and 2.8a).

Single-parent households are not significantly different than the single-person household in their purchasing of pork (Table 2.5a). Moreover, single-parent households are more likely to purchase bellies compared to a single-person household (Table 2.8a). The belly-buying probability of a single-parent household is 0.0436 higher compared to a single-person household (Table 2.8a). Other categories of household are not significantly different in pork purchasing, when compared to single-person households (Table 2.5a). However, other households are more likely to purchase bellies and offal compared to single-person households (Tables 2.8a and 2.11a). The probability of purchasing more bellies and offal is 0.0482 and 0.0367 higher respectively for other households compared to single-person households (Tables 2.8a and 2.11a).

The marginal probability for continuous variable of household size suggests a significant positive effect on the purchase of pork with increasing household size (Table 2.5a). Household size also seems to have a positive effect on the purchase of loins and shoulders (Tables 2.7a and 2.9a). With one unit increase in household size, the probability of purchasing pork increases by 0.1143 (Table 2.5a). Similarly, with one unit increase in household size the probability of buying loins increases by 0.0625 and the

probability of buying shoulders increases by 0237 (Tables 2.7a and 2.9a). The probability of purchasing pork especially loins will, however, increase, but with a diminishing rate following increase in household size, as suggested by the negative sign of the square of household size (SQHSIZE).

Social Assistance:

In terms of purchasing pork, respondents receiving social assistance are not significantly different from those not receiving social assistance (Table 2.5a). However, respondents receiving social assistance are more likely to purchase shoulders compared to respondents not receiving social assistance (Table 2.9a). The probability of purchasing shoulders by social assistance-receiving respondents is 0.0135 higher compared to a respondent not receiving social assistance (Table 2.9a).

Income:

Increasing income does not suggest any significant effect on the probability of purchasing pork. However, respondents are more likely to purchase loins and bellies with increasing income (Table 2.7a and 2.8a). With one unit increase (decrease) in income the probability of buying loins increases (decreases) by 7.04^{-7} (Table 2.7a) and the probability of buying bellies increases (decreases) by 3.45^{-7} (Table 2.8a). The probability of purchasing pork will increase, however, but with a diminishing rate following increases in income; as suggested by the negative sign of the square of income (SQINCOME).

Summary

This chapter assesses the effect of socioeconomic, geographic, and demographic variables on the consumption of pork and its different parts in Canada. The study

focused on ethnic variables along with other factors to see whether Asians consumers differ significantly from other ethnic groups. The Canadian Family Food Expenditure Survey of 1992 was used for this purpose. The goal of the study was to determine the effects of various exogenous factors on the purchasing decision of a consumer buying pork. Along with pork, the effect of explanatory variables was also considered on different parts of pork. Thus, other regressents or parts of pork were legs, loins, bellies, shoulders, hocks, and offal. Given the dichotomous nature of the consumer, a binary probit model was used to find the relations between regressents and regressors, if any. Explanatory variables such as ethnicity and number of years in Canada were the focus of the study. Other explanatory variables included gender, household size, income, and employment along with seasonal, geographic, and educational variables. Most of the explanatory variables were also of a qualitative nature, and to avoid a singularity problem default categories were chosen to define a reference individual and then the variables representing these categories were deleted from the statistical model.

The probit models for pork and parts of pork were estimated, using the econometric software Limdep 7.0. In general, the parameter estimates are statistically significant for both pork and parts of pork. Using the same software (Limdep), marginal effects were also calculated. As most of the explanatory variables are of a qualitative nature, changes in probabilities were obtained for their interpretation. The results from the models suggest that the number of immigration years had a positive effect on pork consumption on immigrants from the United States and Northwestern Europe, but a negative effect on immigrants from Southeastern Europe. There was a decrease in consumption of pork bellies for Asians with an increase in their immigration years; however immigration years seemed to have no other effect on pork purchasing Asian immigrants.

Asians were more likely to consume pork than any other ethnic group in the model, and thus can be considered an identifiable ethnic subgroup. Asians also consume more bellies, shoulders, and hocks than any other ethnic group in the model. Moreover, an increase in immigration years did not affect Asians' higher probability for purchasing

pork. The higher probability of Asians for purchasing pork cuts (except bellies) was also not affected with increase in immigration years of Asians. Pork consumption was less in the third quarter of the year and may also vary geographically. Increasing age had a positive effect on pork consumption, but males and university graduates consumed less pork comparatively. Increasing household size had a positive effect on the consumption of pork, but increasing income had suggested no effect on whether or not to purchase pork or pork cuts.

Table: 2.1 Per Capita Pork Consumption for Selected Countries.

	Kilogram Carcass Weight, Per Capita Per Annum					
Year	United States	Canada	China	Hong Kong	Singapore	Taiwan
1985	30.2	34.2	15.5	45.1	--	38.0
1986	27.5	33.3	16.7	45.3	--	38.1
1987	28.7	33.2	16.8	41.4	--	37.7
1988	30.6	33.9	18.2	45.1	--	36.7
1989	30.4	33.9	18.8	42.6	--	37.5
1990	29.1	31.3	19.9	42.8	--	38.4
1991	29.4	32.4	21.1	40.8	--	38.8
1992	31.0	34.1	22.4	35.1	--	38.8
1993	30.6	33.0	23.9	36.5	--	40.4
1994	31.0	33.2	25.6	38.3	--	39.4
1996	28.7	30.2	25.8	50.4	33.5	41.7
1997	28.5	29.8	29.2	53.1	34.8	39.6
1998	30.7	31.5	31.3	55.0	31.0	44.3
1999	31.5	32.5	32.0	54.9	15.2	42.9
2000 (p)	30.7	32.3	33.0	55.3	12.2	42.8
2001 (f)	31.2	32.7	34.1	55.8	12.5	42.4

Source: USDA Red Meats Yearbook (1995) and USDA Livestock and Poultry: World Markets and Trade (2000)
p (preliminary); f (forecast)

Table 2.2. Variable Codes, Definitions and Statistics for the Survey Data.

Variable Codes	Definitions	Mean	Standard Deviations
Prob	if the consumer purchase pork/part of pork =1, otherwise=0;	0.36	0.48
ASIAN	country of birth China, Asia or Oceana=1, otherwise=0;	0.03	0.16
USNWEURP	country of birth Britain, US, North and West Europe=1, otherwise=0;	0.06	0.24
SEEUROPE	country of birth South and East Europe=1, otherwise=0;	0.03	0.18
OTHERS	country of birth not-stated or other=1, otherwise=0;	0.02	0.15
IMYASIAN	number of immigration years, if belong to China, Asia and Oceania; other wise=0	0.08	0.58
IMYUSNWE	number of immigration years, if belong to Britain, US, North and West Europe; other wise=0	0.39	1.61
IMYSEE	number of immigration years, if belong to South and East Europe; other wise=0	0.19	1.13
IMYOTHER	number of immigration years if belong to not-stated or other; other wise=0	0.08	0.59
QUATR1	survey conducted in first quarter or the year=1, otherwise=0;	0.25	0.43
QUATR2	survey conducted in second quarter or the year=1, otherwise=0;	0.25	0.43
QUATR3	survey conducted in third quarter or the year=1, otherwise=0;	0.25	0.43
QUEBEC	if the household is in Quebec=1, otherwise=0;	0.19	0.39
ONTARIO	if the household is in Ontario=1, otherwise=0;	0.24	0.43
MANITOBA	if the household is in Manitoba=1, otherwise=0;	0.06	0.25
SASKACHW	if the household is in Saskatchewan=1, otherwise=0;	0.09	0.29
ALBERTA	if the household is in Alberta=1, otherwise=0;	0.09	0.28
BRITISHC	if the household is in British Columbia=1, otherwise=0;	0.10	0.31
CITY*	if the household is in urban area=1, otherwise=0;	0.55	0.50
AGE	age	46.00	15.94
MALE	if the respondents is male=1, otherwise=0;	0.55	0.50
UNIVERST	if the respondent is university graduate=1, otherwise=0;	0.13	0.33
FEMEMPL	if respondent is female and employed=1, otherwise=0;	0.15	0.36
HOUSEHD2	married couple=1, otherwise=0;	0.25	0.43
HOUSHD3R	married couple and at least one other person=1, otherwise=0;	0.40	0.49
HDSINGLP	if the respondent is from lone-parent family=1, otherwise=0;	0.08	0.27
OTHERHD	other household=1, otherwise=0;	0.06	0.23
HSIZE	household size, continuous;	2.65	1.37
SOLINDIC	at least one member, receive social assistance=1, otherwise=0;	0.09	0.29
INCOMEBT	income before taxes	41948.0	30230.5

Source: Family Food Expenditure Survey of Canada, 1992 (Statistics Canada).

Note: Categories representing the base individual are deleted from the model (and are not shown in the table) to avoid singularity. Deleted categories are Canadian, quarter 4, Atlantic provinces (Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick, and masked records), Female, education less than university, unemployed female, single person household, no one receiving social assistance.

*City indicates the respondents from 15 selected cities. The selected cities are: St. John's, Halifax, Saint John, Quebec, Montreal, Ottawa, Toronto, Thunder Bay, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver, Victoria.

Table 2.3. Percentage of Households that Purchase Pork and Pork Parts by Ethnicity.

	Born in Canada	Asians	Other Immigrants
Pork	36.17	50.18	34.42
Legs	1.95	2.87	1.94
Loins	29.00	42.29	26.96
Bellies	5.80	15.41	6.14
Shoulders	4.30	10.39	3.89
Hocks	3.00	14.34	3.50
Offal*	5.65	17.92	9.09

Source: Family Food Expenditure Survey of Canada, 1992 (Statistics Canada).

*Pork include Legs, Loins, Bellies, Shoulder and Hocks but not Offal. Offal is from all mammals.

Table 2.4. Characteristics of Family Food Expenditure Survey of Canada.

Socioeconomic and Demographic Characteristics	Categories	Representation in the Sample (%)
Country of Birth	China, Asia and Oceania	2.62
	Britain, USA, NW Europe	6.41
	South and East Europe	3.27
	Canada	85.31
	Other and not stated	2.39
Immigration Years	Less than 5	1.96
	5 to less than 16	2.50
	16 to less than 26	3.74
	All others (Including Canadian)	91.80
Quarter of the year	1st Quarter1	24.51
	2nd Quarter2	25.30
	3rd Quarter3	25.13
	Fourth Quarter4	25.06
Province of Survey	Quebec	18.59
	Ontario	23.82
	Manitoba	6.42
	Saskatchewan	8.97
	Alberta	8.61
	British Columbia	10.42
	All other	23.18
City Indicator (If living in 15 selected cities)	City	45.30
	Not in City	54.70
Age	Age 24 years and Under	5.86
	Age 25-75 years	88.12
	Age 76 years and Older	6.02
Gender	Male	54.56
	Female	45.44
Education	Secondary	41.21
	Post Secondary	30.67
	University	12.71
	All other	15.41
Employment	Full time	45.12
	Part time	23.35
	Not working	31.54
Household Composition	One person	21.57
	Married couple	25.05
	Married couple with single child or relative/non-relative	39.60
	Lone parent family	7.94
	All others	5.84
Social Assistance Indicator	No member of household receive it	91.06
	At least one member of household receive it	8.94
Household Income Before Taxes	Less than 10K	7.69
	10 to less than 30K	33.58
	30 to less than 60K	36.14
	60 to less than 100K	17.88
	More than 100K	4.71

Source: Family Food Expenditure Survey of Canada, 1992 (Statistics Canada).

Table 2.5a. Estimates of the Binary Probit Model for Pork.

Variables	Coeff.	t-ratio	Marginals	Change in Probability
ONE	-1.4798	-9.37	-0.5519	------
ASIAN	0.4282***	2.93	0.1597	0.1673
USNWEURP	-0.2679*	-1.85	-0.0999	-0.0949
SEEUROPE	0.3545*	1.81	0.1322	0.1379
OTHERS	-0.4024**	-2.38	-0.1501	-0.1367
IMYASIAN	-0.0158	-0.40	-0.0059	-0.0059
IMYUSNWE	0.0436**	1.97	0.0163	0.0163
IMYSEE	-0.0612**	-1.97	-0.0228	-0.0227
IMYOTHER	0.0626	1.49	0.0234	0.0236
QUATR1	0.0357	1.00	0.0133	0.0134
QUATR2	-0.0144	-0.40	-0.0054	-0.0054
QUATR3	-0.0781**	-2.18	-0.0291	-0.0289
QUEBEC	-0.0427	-1.08	-0.0159	-0.0159
ONTARIO	-0.0826**	-2.17	-0.0308	-0.0306
MANITOBA	-0.2198***	-3.84	-0.0820	-0.0787
SASKACHW	-0.1643***	-3.23	-0.0613	-0.0596
ALBERTA	-0.2256***	-4.32	-0.0841	-0.0808
BRITISHC	-0.1078**	-2.23	-0.0402	-0.0395
CITY	-0.0381	-1.42	-0.0142	-0.0142
AGE	0.0205***	3.33	0.0076	0.0035
SQAGE	-0.0002***	-2.76	-0.0001	-0.0001
MALE	-0.0547*	-1.74	-0.0204	-0.0204
UNIVERST	-0.0914**	-2.23	-0.0341	-0.0336
FEMEMPL	-0.0123	-0.28	-0.0046	-0.0046
HOUSEHD2	0.2878***	4.05	0.1073	0.1096
HOUSHD3R	0.2987**	2.55	0.1114	0.1123
HDSINGLP	0.1084	1.14	0.0404	0.0411
OTHERHD	0.1042	1.05	0.0388	0.0395
HSIZE	0.3065***	3.54	0.1143	0.0722
SQHSIZE	-0.0356***	-3.59	-0.0133	-0.0142
SOLINDIC	-0.0364	-0.73	-0.0136	-0.0135
INCOMEBT	1.68E-06	1.61	6.28E-07	6.11E-07
SQINCOME	9.53E-12*	-1.70	-3.55E-12	-3.59E-12

R Square	0.0465
Log likelihood fn.	-6723.77
likelihood ratio test	519.7320

* Statistically significant at 10% level of significance, ** at 5% level and *** 1 % level.

Table: 2.5b Predictions of Success of the Model.

Pork		Predicted		Total
		0	1	
Actual	0	6441	344	6785
	1	3525	347	3872
Total		9966	691	10657
Number of Right Predictions	=	6788		
Percentage of Right Predictions	=	63.70		

Table 2.6a. Estimates of the Binary Probit Model for Legs.

Variables	Coeff.	t-ratio	Marginals	Change in Probability
ONE	-3.5010***	-9.31	-0.1412	------
ASIAN	0.4001	1.30	0.0161	0.0242
USNWEURP	0.0895	0.27	0.0036	0.0039
SEEUROPE	-0.3900	-0.73	-0.0157	-0.0108
OTHERS	-0.4649	-0.89	-0.0187	-0.0119
IMYASIAN	-0.0818	-0.87	-0.0033	-0.0031
IMYUSNWE	-0.0129	-0.26	-0.0005	-0.0005
IMYSEE	0.0737	0.96	0.0030	0.0031
IMYOTHER	0.0886	0.79	0.0036	0.0039
QUATR1	0.266***	3.21	0.0107	0.0125
QUATR2	0.1477*	1.73	0.0060	0.0065
QUATR3	0.0361	0.40	0.0015	0.0015
QUEBEC	-0.0103	-0.12	-0.0004	-0.0004
ONTARIO	-0.2121**	-2.37	-0.0086	-0.0076
MANITOBA	-0.2239	-1.61	-0.0090	-0.0074
SASKACHW	-0.0560	-0.50	-0.0023	-0.0021
ALBERTA	-0.2851**	-2.13	-0.0115	-0.0090
BRITISHC	-0.0751	-0.69	-0.0030	-0.0028
CITY	0.0314	0.50	0.0013	0.0013
AGE	0.0261*	1.77	0.0011	0.0000
SQAGE	-0.0002	-1.12	0.0000	0.0000
MALE	-0.0333	-0.46	-0.0013	-0.0013
UNIVERST	-0.0623	-0.62	-0.0025	-0.0024
FEMEMPL	-0.0938	-0.87	-0.0038	-0.0035
HOUSEHD2	0.1394	0.92	0.0056	0.0061
HOUSHD3R	0.0804	0.33	0.0032	0.0033
HDSINGLP	0.1787	0.89	0.0072	0.0085
OTHERHD	0.1786	0.83	0.0072	0.0085
HSIZE	0.2120	1.37	0.0085	0.0029
SQHSIZE	-0.0140	-0.84	-0.0006	-0.0007
SOLINDIC	-0.0769	-0.64	-0.0031	-0.0029
INCOMEBT	0.0000	0.74	9.98E-08	7.95E-08
SQINCOME	0.0000	-0.99	-9.54E-13	-1.09E-12

R Square	0.0076
Log likelihood fn.	-989.0391
likelihood ratio test	87.0398

* Statistically significant at 10% level of significance, ** at 5% level and *** 1 % level.

Table: 2.6b Predictions of Success of the Model.

Leg		Predicted		Total
		0	1	
Actual	0	10447	0	10447
	1	210	0	210
Total		10657	0	10657

Number of Right Predictions	=	10447
Percentage of Right Predictions	=	98.03

Table 2.7a. Estimates of the Binary Probit Model for Loins.

Variables	Coeff.	t-ratio	Marginals	Change in Probability
ONE	-1.4547***	-9.01	-0.4926	-------
ASIAN	0.5713***	3.88	0.1935	0.2151
USNWEURP	-0.2745*	-1.82	-0.0929	-0.0860
SEEUROPE	0.5935***	2.98	0.2010	0.2237
OTHERS	-0.2269	-1.31	-0.0768	-0.0717
IMYASIAN	-0.0655	-1.63	-0.0222	-0.0218
IMYUSNWE	0.0395*	1.71	0.0134	0.0134
IMYSEE	-0.1090***	-3.37	-0.0369	-0.0362
IMYOTHER	0.0275	0.63	0.0093	0.0094
QUATR1	0.0331	0.89	0.0112	0.0113
QUATR2	0.0147	0.40	0.0050	0.0050
QUATR3	-0.0172	-0.47	-0.0058	-0.0058
QUEBEC	-0.0938**	-2.30	-0.0318	-0.0312
ONTARIO	-0.07889**	-2.01	-0.0267	-0.0264
MANITOBA	-0.2246***	-3.77	-0.0761	-0.0715
SASKACHW	-0.1865***	-3.54	-0.0632	-0.0602
ALBERTA	-0.2104***	-3.91	-0.0713	-0.0675
BRITISHC	-0.1593***	-3.17	-0.0539	-0.0519
CITY	-0.0217	-0.78	-0.0074	-0.0074
AGE	0.0171***	2.67	0.0058	0.0027
SQAGE	-0.0002**	-2.41	-0.0001	-0.0001
MALE	-0.0297	-0.92	-0.0101	-0.0101
UNIVERST	-0.1128***	-2.66	-0.0382	-0.0372
FEMEMPL	-0.0167	-0.37	-0.0057	-0.0057
HOUSEHD2	0.3250***	4.56	0.1101	0.1145
HOUSHD3R	0.3506***	2.99	0.1187	0.1207
HDSINGLP	0.1566	1.62	0.0530	0.0549
OTHERHD	0.1400	1.40	0.0474	0.0490
HSIZE	0.1846**	2.19	0.0625	0.0460
SQHSIZE	-0.0211**	-2.22	-0.0071	-0.0078
SOLINDIC	-0.0708	-1.36	-0.0240	-0.0236
INCOMEBT	2.20E-06**	2.05	7.45E-07	7.04E-07
SQINCOME	-8.58E-12	-1.50	-2.90E-12	-2.94E-12

R Square	0.0382
Log likelihood fn.	-6213.953
likelihood ratio test	426.8360

* Statistically significant at 10% level of significance, ** at 5% level and *** 1 % level.

Table: 2.7b Predictions of Success of the Model.

Loins		Predicted		Total
		0	1	
Actual	0	7518	37	7555
	1	3068	34	3102
Total		10586	71	10657
Number of Right Predictions	=	7552		
Percentage of Right Predictions	=	70.86		

Table 2.8a. Estimates of the Binary Probit Model for Bellies.

Variables	Coeff.	t-ratio	Marginals	Change in Probability
ONE	-2.4436***	-10.02	-0.2651	--------
ASIAN	0.9097***	5.04	0.0987	0.1826
USNWEURP	-0.5072*	-1.82	-0.0550	-0.0385
SEEUROPE	0.6280**	2.53	0.0681	0.1060
OTHERS	0.0392	0.16	0.0042	0.0044
IMYASIAN	-0.1395**	-2.57	-0.0151	-0.0138
IMYUSNWE	0.0462	1.11	0.0050	0.0051
IMYSEE	-0.0584	-1.45	-0.0063	-0.0062
IMYOTHER	-0.0027	-0.04	-0.0003	-0.0003
QUATR1	0.0143	0.26	0.0015	0.0016
QUATR2	0.0067	0.12	0.0007	0.0007
QUATR3	-0.0675	-1.19	-0.0073	-0.0071
QUEBEC	-0.2836***	-4.08	-0.0308	-0.0267
ONTARIO	0.0162	0.27	0.0018	0.0018
MANITOBA	0.0136	0.15	0.0015	0.0015
SASKACHW	0.1482**	1.97	0.0161	0.0177
ALBERTA	0.0899	1.16	0.0098	0.0104
BRITISHC	0.0784	1.06	0.0085	0.0089
CITY	-0.0101	-0.24	-0.0011	-0.0011
AGE	0.0175*	1.76	0.0019	0.0004
SQAGE	-0.0001	-1.44	0.0000	0.0000
MALE	-0.0491	-1.00	-0.0053	-0.0053
UNIVERST	-0.2106***	-3.12	-0.0228	-0.0201
FEMEMPL	0.0200	0.30	0.0022	0.0022
HOUSEHD2	0.3755***	3.71	0.0407	0.0475
HOUSHD3R	0.5293***	3.32	0.0574	0.0637
HDSINGLP	0.3237**	2.39	0.0351	0.0436
OTHERHD	0.3489**	2.48	0.0379	0.0482
HSIZE	-0.0118	-0.12	-0.0013	-0.0013
SQHSIZE	0.0025	0.23	0.0003	0.0003
SOLINDIC	0.0620	0.79	0.0067	0.0070
INCOMEBT	3.18E-06*	1.80	3.45E-07	2.76E-07
SQINCOME	-1.08E-11	-1.08	-1.17E-12	-1.23E-12

R Square	0.0206
Log likelihood fn.	-2339.771
likelihood ratio test	216.0800

* Statistically significant at 10% level of significance, ** at 5% level and *** 1 % level.

Table: 2.8b Predictions of Success of the Model.

Bellies		Predicted		Total
		0	1	
Actual	0	10007	0	10007
	1	650	0	650
Total		10657	0	10657
Number of Right Predictions	=	10007		
Percentage of Right Predictions	=	93.90		

Table 2.9a. Estimates of the Binary Probit Model for Shoulder.

Variables	Coeff.	t-ratio	Marginals	Change in Probability
ONE	-2.8966***	-10.45	-0.2380	---------
ASIAN	0.4856**	2.33	0.0399	0.0593
USNWEURP	-0.3233	-1.10	-0.0266	-0.0207
SEEUROPE	-0.3804	-1.04	-0.0313	-0.0228
OTHERS	-0.6919	-1.60	-0.0569	-0.0320
IMYASIAN	-0.0056	-0.10	-0.0005	-0.0005
IMYUSNWE	0.0389	0.88	0.0032	0.0032
IMYSEE	0.0982*	1.81	0.0081	0.0085
IMYOTHER	0.0994	1.05	0.0082	0.0088
QUATR1	0.1526**	2.52	0.0125	0.0135
QUATR2	-0.0510	-0.80	-0.0042	-0.0041
QUATR3	-0.0123	-0.19	-0.0010	-0.0010
QUEBEC	-0.2487***	-3.61	-0.0204	-0.0178
ONTARIO	-0.2065***	-3.22	-0.0170	-0.0155
MANITOBA	-0.2936***	-2.82	-0.0241	-0.0192
SASKACHW	-0.1997**	-2.27	-0.0164	-0.0142
ALBERTA	-0.3870***	-3.89	-0.0318	-0.0240
BRITISHC	-0.1011	-1.26	-0.0083	-0.0077
CITY	-0.0808*	-1.73	-0.0066	-0.0067
AGE	0.0318***	2.87	0.0026	0.0001
SQAGE	-0.0003***	-2.65	0.0000	-0.0001
MALE	-0.0174	-0.32	-0.0014	-0.0014
UNIVERST	-0.0769	-1.02	-0.0063	-0.0060
FEMEMPL	0.0184	0.24	0.0015	0.0015
HOUSEHD2	0.0905	0.77	0.0074	0.0077
HOUSHD3R	-0.0575	-0.30	-0.0047	-0.0047
HDSINGLP	-0.1243	-0.77	-0.0102	-0.0093
OTHERHD	-0.1677	-0.96	-0.0138	-0.0121
HSIZE	0.2890**	2.28	0.0237	0.0066
SQHSIZE	-0.0221	-1.60	-0.0018	-0.0025
SOLINDIC	0.1478*	1.78	0.0121	0.0135
INCOMEBT	1.66E-06	0.69	1.37E-07	1.20E-07
SQINCOME	-2.12E-11	-1.30	-1.74E-12	-1.93E-12

R Square	0.0165
Log likelihood fn.	-1838.967
likelihood ratio test	174.9920

* Statistically significant at 10% level of significance, ** at 5% level and *** 1 % level.

Table: 2.9b Predictions of Success of the Model.

Shoulders		Predicted		Total
		0	1	
Actual	0	10187	0	10187
	1	470	0	470
Total		10657	0	10657
Number of Right Predictions	=	10187		
Percentage of Right Predictions	=	95.59		

Table 2.10a. Estimates of the Binary Probit Model for Hocks.

Variables	Coeff.	t-ratio	Marginals	Change in Probability
ONE	-3.0477***	-9.39	-0.1763	-------
ASIAN	1.2258***	6.77	0.0709	0.1973
USNWEURP	-0.4615	-1.28	-0.0267	-0.0182
SEEUROPE	0.6578**	2.22	0.0381	0.0685
OTHERS	-0.4052	-1.12	-0.0234	-0.0161
IMYASIAN	-0.0785	-1.56	-0.0045	-0.0043
IMYUSNWE	0.0763	1.52	0.0044	0.0045
IMYSEE	-0.0667	-1.38	-0.0039	-0.0037
IMYOTHER	0.1123	1.44	0.0065	0.0071
QUATR1	-0.1616**	-2.48	-0.0094	-0.0086
QUATR2	-0.3301***	-4.81	-0.0191	-0.0165
QUATR3	-0.3837***	-5.41	-0.0222	-0.0187
QUEBEC	0.6303***	8.34	0.0365	0.0546
ONTARIO	0.1433*	1.74	0.0083	0.0089
MANITOBA	0.0866	0.71	0.0050	0.0054
SASKACHW	-0.0449	-0.37	-0.0026	-0.0025
ALBERTA	0.0784	0.70	0.0045	0.0048
BRITISHC	0.0495	0.47	0.0029	0.0030
CITY	-0.0561	-1.05	-0.0032	-0.0033
AGE	0.0344***	2.79	0.0020	2.69E-05
SQAGE	-0.0003**	-2.22	-1.59E-05	-4.64E-05
MALE	-0.0672	-1.09	-0.0039	-0.0039
UNIVERST	-0.0413	-0.49	-0.0024	-0.0023
FEMEMPL	-0.1532	-1.64	-0.0089	-0.0080
HOUSEHD2	0.2714*	1.89	0.0157	0.0180
HOUSHD3R	0.2504	1.07	0.0145	0.0154
HDSINGLP	0.1062	0.55	0.0061	0.0067
OTHERHD	0.3167	1.59	0.0183	0.0241
HSIZE	0.1122	0.64	0.0065	0.0039
SQHSIZE	-0.0127	-0.63	-0.0007	-0.0009
SOLINDIC	-0.1187	-1.19	-0.0069	-0.0062
INCOMEBT	-3.09E-06	-1.51	-1.79E-07	-2.29E-07
SQINCOME	1.11E-11	1.03	6.44E-13	6.07E-13

R Square	0.0318
Log likelihood fn.	-1429.851
likelihood ratio test	280.5520

* Statistically significant at 10% level of significance, ** at 5% level and *** 1 % level.

Table: 2.10b Predictions of Success of the Model.

Hocks		Predicted		Total
		0	1	
Actual	0	10297	1	10298
	1	359	0	359
Total		10656	1	10657
Number of Right Predictions	=	10297		
Percentage of Right Predictions	=	96.62		

Table 2.11a. Estimates of the Binary Probit Model for Offal.

Variables	Coeff.	t-ratio	Marginals	Change in Probability
ONE	-2.805***	-11.41	-0.3119	--------
ASIAN	1.0196***	5.78	0.1134	0.2203
USNWEURP	-0.0280	-0.12	-0.0031	-0.0031
SEEUROPE	1.1153***	4.91	0.1240	0.2506
OTHERS	0.7827***	3.44	0.0870	0.1491
IMYASIAN	-0.0754	-1.51	-0.0084	-0.0080
IMYUSNWE	0.0261	0.77	0.0029	0.0029
IMYSEE	-0.1172***	-3.15	-0.0130	-0.0123
IMYOTHER	-0.1831**	-2.56	-0.0204	-0.0180
QUATR1	0.1046*	1.94	0.0116	0.0121
QUATR2	-0.0453	-0.82	-0.0050	-0.0049
QUATR3	-0.1149**	-2.02	-0.0128	-0.0122
QUEBEC	0.2486***	4.29	0.0276	0.0313
ONTARIO	-0.0708	-1.17	-0.0079	-0.0076
MANITOBA	-0.0671	-0.75	-0.0075	-0.0071
SASKACHW	-0.2422***	-2.73	-0.0269	-0.0230
ALBERTA	-0.1127	-1.35	-0.0125	-0.0116
BRITISHC	-0.2477***	-3.01	-0.0275	-0.0235
CITY	0.0237	0.56	0.0026	0.0026
AGE	0.0366***	3.77	0.0041	0.0001
SQAGE	-0.0003***	-2.66	-2.87E-05	-0.0001
MALE	-0.0884*	-1.84	-0.0098	-0.0099
UNIVERST	-0.0992	-1.47	-0.0110	-0.0104
FEMEMPL	-0.0824	-1.16	-0.0092	-0.0087
HOUSEHD2	0.2120**	2.24	0.0236	0.0257
HOUSHD3R	0.1493	0.95	0.0166	0.0170
HDSINGLP	0.0170	0.13	0.0019	0.0019
OTHERHD	0.2731**	2.00	0.0304	0.0367
HSIZE	0.0172	0.17	0.0019	0.0018
SQHSIZE	2.36E-03	0.22	0.0003	0.0003
SOLINDIC	0.0338	0.44	0.0038	0.0038
INCOMEBT	6.61E-07	0.33	7.35E-08	7.03E-08
SQINCOME	-1.17E-11	-0.92	-1.30E-12	-1.37E-12

R Square	0.0277
Log likelihood fn.	-2394.297
likelihood ratio test	274.9900

* Statistically significant at 10% level of significance, ** at 5% level and *** 1 % level.

Table: 2.11b Predictions of Success of the Model.

Offal		Predicted		Total
		0	1	
Actual	0	9976	0	9976
	1	681	0	681
Total		10657	0	10657

Number of Right Predictions	=	9976
Percentage of Right Predictions	=	93.61

Table 2.12. Country of Birth Statistics for the Survey Data.

Country of Birth	Definition	Mean	Standard Deviation
Canada	Respondent born in Canada	0.8531	0.3541
USNWEURP	Respondent born in Britain, USA, North and West Europe Britain and U.K., USA, Greenland, St. Pierre and Miquelon, Finland,Iceland, Norway, Ireland, Sweden, Germany, Austria, Belgium, France, Luxembourg, Netherlands, Switzerland, Liechtenstein, Monaco, Other Western European Countries	0.0641	0.2449
SEEUROPE	Respondent born in South and East Europe (SEURP) Italy, Greece, Malta, Portugal, Spain, Albania, Yugoslavia (Serbia, Croatia, Bosnia, Slovenia), Andorra, Cyprus, Gibraltar, San Marino, Vatican City State, Other Southern , European Countries, Poland, Czechoslovakia, Hungary, Romania, U.S.S.R., Bulgaria, Ukraine, Estonia, Armenia, Georgia, Latvia, Russia, Lithuania, Other Eastern European Countries	0.0327	0.1780
ASIAN	China, Asia and Oceania China, Hong Kong, Japan, Korea, Taiwan, Vietnam. Macao, Mongolia, Brunei, Union of Myanmar, Kampuchea, Laos, Malaysia, Philippines, Singapore, Thailand, Bangladesh, India, Pakistan, Punjab,Sri Lanka, Cambodia, Indonesia, Malaya, Bhutan, Maldives, Australia, New Zealand, America Samoa, Belaulaysia, Cook Islands, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Micronesia, New Caledonia, Papua New Guinea,, Pitcairn Island, Solomon Islands, Tonga, Tuvalu, US Pacific Trust Territories, Vanuata, Wallis and Futuna, Western Samoa	0.0262	0.1597
OTHERS	Other and Not Stated Iran, Iraq, Israel, Lebanon, Syria, Afghanistan, Turkey, Bahrain, Jordan, Kuwait, Oman, Qatar, Saudia Arabia, United Arab Emirates, Yemen, Other Middle Eastern Countries, Kenya, Morocco, Sudan, ganda, Algeria, Benin, Burkina Faso, Cape Verde Islands, Egypt, Libya, Tunisia, Western Sahara, Zambia, Gambia, Ghana, Guinea, Guines-Bissau, Ivory Coast, Liberia, Mali, Mauritania, Namibia, Niger, Nigeria, Senegal, Sierra Leone, St. Helena and Ascension, Togo, Burundi, Comoros, Djibouti, Ethopia, Madagascar, Malawi, Mauritius, Mayotte, Reunion, Seychelles, Somali, South Africa, Zimbawia, Mozambique, Angola, Batswani, Cameroon, Congo, Central Africa Republic, Equatorial Guinea, Gabon, Zaire, Tanzania, Sao Tome and Principe, Botswana, Lesotho, Zimbabwe, Swaziland, Other African Countries, Guyana, Guiana, Mexico, Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Argentina, Bolivia, Brazil, Chile, Columbia, Ecuador, Falkland Islands, Paraguay, Peru, Suriname, Uruguay, Venezuella, Other Central American Countries, Barbados, Cuba, Dominican Republic, Haiti, Jamaica, Puerto Rico, Trinidad and Tobago, Anguilla, Antigua, Aruba, Bahamas, Cayman Islands, Dominica, Grenada, Guadeloupe, Martinique, Montserrat, Netherlands Antilles, St. Christopher and Nevis, St. Lucia, St. Vincent and the Grenadines, Turks and Caicos, Virgin Islands (British),Virgin Islands (USA), Other West Indies, Not Stated.	0.0239	0.1528

Source: Family Food Expenditure Survey of Canada, 1992 (Statistics Canada).

Chapter 3

Importance Rankings for Pork Attributes by Asian-Origin Consumers in California

Background

The large size of the Californian market and the fact that most pork consumed there must be shipped into this region makes this a market of interest to pork exporters. Pork is the primary meat consumed in the diets of many Asian-origin consumers. Because a large proportion of America's Asian-origin population resides in this state (Kuperis et al 1997)—and this population is increasing (Kuperis et al 1997)—the ethnic Asian-origin market in California has been suggested by some market researchers to be a potential niche market for fresh Canadian pork (Kuperis et al 1997). To effectively meet the requirements for such a segment of ethnic consumers, marketers need to identify and understand the nature of pork attributes that are most valued by ethnic-origin Asian consumers as well as the factors that determine their preferences. Such knowledge will enable exporters to determine more effective marketing strategies to penetrate this market segment. For this purpose, the ethnic Asian market for fresh pork in San Francisco was chosen as the market to be studied in this investigation. The selection of San Francisco is due to its large Asian population (U.S. Census Bureau) and its geographic proximity to Western-Canadian provinces.

Many studies have investigated consumers' attitudes towards meat purchases and meat consumption (Hui et al 1995, Capps and Schmitz 1991, Jordan and Elnagheeb 1991, Frazao and Cleveland 1994, Menkhaus et al 1985, Smallwood et al 1994, Senauer et al 1992, Tippett and Goldman 1994, Wohlgenant et al 1985). One finding of these studies is that geographic, demographic, and socioeconomic factors can be important factors in determining consumers' preferences toward meat consumption. Most of these studies have focused on the aggregate consumption of individual meats, aggregate meat consumption, and selected attributes of meats. There has been little focus on the preferences of Asian-origin consumers. This chapter examines how Asian-origin

consumers rank a variety of selected attributes of fresh pork, and then evaluates the simultaneous effects of demographic and socioeconomic factors of Asian consumers on their preferences for these attributes of pork. The data applied in this study is from a survey of Asian-origin consumers conducted in San Francisco, California in 1998. A total of 173 Asian consumers were intercepted at small Asian stores, large Asian stores, American-style Asian supermarkets, and Asian butcher shops. As the sample that resulted from this sampling method is choice (store)-based, an ordered probit model (which is amenable to the choice-based sampling procedure) was applied to investigate the effects of demographic and socioeconomic factors of the sampled Asian-origin consumers on their preferences for fresh pork attributes.

Survey Design and Data Collection

Survey Design

The ranking survey was designed to elicit information on each consumer's perception of quality attributes, and to evaluate the effects of demographic and socioeconomic factors on the perception of fresh pork in California. The development of the survey was based on previous literature on consumer meat studies (Hui et al 1995, Goodwin and Koudele 1990, Kinsey et al 1993) that provided a framework for the design of the survey. However, the pre-testing and testing of the survey dictated both the number of questions that could be asked and how detailed the questions could be (Le 1999).

The survey researcher (Le 1999) surveyed 50 Asian customers from large and small Asian stores in Edmonton to determine the amount of time a respondent would want to be interviewed, so that an appropriate length for the survey questionnaire could be developed. The survey was designed to only take about five minutes to complete, as this was the maximum amount of time respondents wanted to be interviewed. It was observed that for any length of time longer than that, the respondent would just walk

away. Each question in the survey was pre-tested to ensure that the questions were easy to answer and well understood by the respondent. The survey was pre-tested at small and large Asian stores in Chinatown in Edmonton, Alberta. The survey was also pre-tested in Chinatown in Vancouver, British Columbia as well as at a large Asian store in Coquitlam, a suburb of Vancouver. Information obtained from consultation with retailers of small Asian stores and wholesalers in San Francisco's main Chinatown was used to ensure that the characteristics of the San Francisco market were incorporated into the questionnaire. Appendix 1 provides a copy of the ranking survey used in San Francisco.

There are three main types of questions: classification questions, attitudinal questions, and behavioral questions, and all are used in all types of survey. All three types of questions are included in this survey. Classification questions are used to build a profile of the respondent and include the information that differentiates them from one another. Question 1, 2 and 8 to 15 in the questionnaire (Appendix 1) are classification questions. These are questions about ethnic background, place of birth, number of years in the United States, household size, income, age, job status, and education. The interviewer notes the date, time, location, store types, and gender of the respondent in the beginning.

As described by Le (1999), there are a number of ways in which attitudes can be measured, e.g. observation of behavior, psychological reactions, self-reports, etc. The most common approach is self-reports. In self-reports, people are asked directly for their feelings about an object. There are many ways to measure self-reports: equal appearing intervals, summated ratings, a semantic differential, and rating scales. Even though all measuring methods of attitudes are controversial and criticized, a rating scale is usually preferred. Some important ways to measure ratings include graphic, itemized, and comparative ratings. Question 3 is based on itemized ratings to measure the importance of 13 fresh pork attributes. Itemized ratings involve selection of a category from a limited number of categories, with least and most important categories at the ends. Question 4 is based on comparative rating; it compares 6 attributes of pork with direct reference to other attributes.

The third types of questions used in the survey are about the lifestyle of the respondent, and are called behavioral questions. As compared to the attitudinal questions, these are facts about the respondent instead of respondent's opinion and usually include yes and no types of questions, e.g. do you only buy the leanest pork? Four behavioral questions—1, 2, 6, and 7—are included in the survey. These questions are about the type of store, frequency of buying pork, being a main cook and being a main grocery shopper.

Data Collection

Theresa Le, a former graduate student of the Department of Rural Economy of the University of Alberta, collected the data in San Francisco, from September to October 1998. Some 173 surveys interviews were conducted for collection of data at large and small Asian stores, American-style supermarkets, and butcher shops in San Francisco, California.

Different types of methods were considered for data collection. Mailing out the surveys or conducting a telephone survey was considered to be too expensive and it would be difficult to obtain an appropriate mailing list. Furthermore, there was a degree of uncertainty concerning the response rate, as respondents would have to mail their responses back to Canada. In addition, mail-out surveys offer little control on the size of the sample. Thus, a mall-intercept method was used to collect the by Le (1999) data.

The mall intercept is a method of data collection wherein the interviewer intercepts shoppers in a shopping mall or in the vicinity of the store; the interviewer intercepts a sample of passers by requesting them to participate in the research study (Churchill 1996). Mall intercepts provide the "most sample control with respect to obtaining cooperation from the designated respondents" (Churchill 1996:193). In this study the researcher intercepted consumers after they finished their grocery shopping at small and large Asian stores, American stores, and butcher shops, and these consumers

were asked if they would agree to participate in the study. The criteria for a willing consumer to be included in the sample were based on two features. Specifically, the respondent must be a consumer and a purchaser of fresh pork, and must be of Asian descent.

The sample was drawn from consumers who shopped at small and large Asian grocery stores or supermarkets, meat specialty stores, and American-style supermarkets. One reason for sampling from these four types of stores was to ensure that consumers from all store types were represented. However, it should be emphasized that the sample drawn is not random.

Collecting a random sample presented two problems at the time the interviews were being conducted. First, store-owners were not particularly keen on having someone standing outside their store for an extended period of time. Thus, the researcher had to travel from one store to another to avoid possible negative ramifications for store-owners. Second, the researcher wanted to ensure that there was a large enough sample of Asian participants who consumed and purchased pork.

To elicit information on consumers' perceptions of attributes of fresh pork in San Francisco, the self-explication approach[4] outlined below was adopted in the survey. The advantage of this approach is that it is simple to use, particularly when large numbers of attributes are of interest, as is the case in this study. Moreover, empirical results have suggested that this approach is likely to yield predictions that are roughly comparable to those of traditional conjoint analysis (Green and Srinivasan 1990).

The nature of the self-explication procedure is that respondents were first asked to evaluate the importance level (rating) of each attribute using a scale from 1 to 5, with 1

[4] The self-explication approach has several possible problems. For example, substantial inter-correlation may apply between attributes and this can make it difficult for the respondent to provide ratings for levels of an attribute, holding all else constant. Another potential problem is that the question of "How important is an attribute?" can be viewed as ambiguous, in that the respondent may answer in terms of his/her own range of experience rather than relative to the experimentally-defined range of attribute levels [Green and Srinivasan 1990].

representing "not important at all" and 5 representing "extremely important" as an attribute. Respondents were then asked to allocate a specific number of points (re-specified as being 1 to 6 with 1 representing the least important attribute and 6 representing the most important attribute) across the attributes to reflect their relative importance or ranking. The respondents' importance rankings, termed as "part-worths" in the language of the marketing literature on attribute valuation (Green and Srinivasan 1990, p 9), for each attribute are obtained by multiplying the rating for each attribute and the comparative ranking of that attribute.

As described by Le (1999) a total of 173 Asian-origin consumers were successfully intercepted at small Asian stores, large Asian stores, American-style Asian supermarkets, and Asian butcher shops in the Chinatown regions of San Francisco during the period from September to October 1998. The criteria for each individual respondent to be included in the sample were that each individual must be a consumer of pork and be of Asian descent. In the collection of the data, an effort was made to obtain an approximately equal number of respondents from each of the four types of stores. The data collected from small Asian stores came from "Main Chinatown" and the "New Chinatown" districts of San Francisco. The data for large Asian stores was collected from customers of the "99" Ranch Markets located in suburban areas of San Francisco. Customers of American-style supermarkets were sought from Asian-origin customers of Safeway, Andornico's, and Cala Foods outlets in the Chinatown regions. The data for customers of meat specialty stores was collected in the main Chinatown area.

About 61% of the survey interviews were conducted in English and 39% of the surveys were conducted in Chinese with the assistance of a mandarin Chinese translator. The day of the week on which the largest number of surveys was conducted was Saturday (25%), while the least number of survey interviews was conducted on Monday and Wednesday (10%). On Sunday, Thursday, Tuesday, and Friday the number of surveys conducted was 18%, 14%, 12%, and 11%, respectively. 65% of the surveys were conducted during the hours of 2:00 p.m. to 5:00 p.m. Of the 173 surveys, 35% were

conducted at American-style supermarkets, 29% at meat specialty stores, 28% at large Asian grocery supermarkets, and 8% at small Asian (independent) grocery stores.

To assess the representativeness of the sample in terms of the demographic structure of the Asian-origin population of San Francisco, survey statistics on gender, ethnic background, and age structure are given in Table 3.1. The survey sample has a slightly higher proportion of females, as might be expected since females may be more likely to undertake grocery shopping. Filipino and Koreans are under-represented in our survey while Chinese-origin respondents are over-represented. The group of lowest age (less than or equal to 24 years) is under-represented as might be expected since the census data for San Francisco also includes the non-shopping population, that is infants and young children under the age of 10. Age categories of 25-34 and 35-44 years are over-represented. In general these age differences might be expected in terms of the sampled population of food shoppers.

Importance Rankings by Asian-origin Consumers for Pork Attributes

The importance rankings for thirteen pork attributes are summarized in Figure 3.1. Large part worth figures indicate high valuations by the surveyed consumers. On average, Asian-origin consumers value freshness most highly; the color of meat is ranked second, a low amount of fat is third, whiteness of fat is fourth, price is fifth, freedom from chemicals is sixth, and having a USDA label is seventh. Seasoned and prepared pork was considered the least important attribute. To determine whether or not Asian-origin consumers differentiate between these various pork attributes, non-parametric tests, including the Kruskal-Wallis test and Dunn's procedure (Berenson and Levine 1996), were applied.

Kruskal-Wallis Rank Test:

In order to see that the fresh pork attributes do significantly differ from one another and that respondents differentiate the importance of pork attributes, several

possible tests can be used. The most commonly used test is the one-way ANOVA *F* test—a parametric test. However, these tests make more stringent assumptions (normality, for instance) compared to non-parametric counterparts. For situations we cannot make or do not wish to make the assumption that the populations having equal variances are normally distributed; a distribution free Kruskal-Wallis rank test, for differences in medians, is used. This has proven to be almost as powerful as the *F* test, when conditions for the classical *F* test are appropriate and even more powerful when the assumptions of the *F* test are violated (Berenson and Levine 1996).

To perform the Kruskal-Wallis test we must replace the observations in all groups with their combined ranks. The ranks are assigned in such a manner that rank 1 is given to the smallest of the $n = n_1 + n_2 ... + n_c$ combined observations; rank 2 is given to the second smallest, and so on until rank *n* is given to the largest observation. If several values are tied, we assign each the average of the ranks that would otherwise have been assigned.

The Kruskal-Wallis rank test is used to test whether the *c* (13 in this case) independent-sample-groups have been drawn from populations possessing equal medians. In other words we test

$$H_0: M_1=M_2=\ldots=M_C$$

The alternative hypothesis is

$$H_1: \text{Not all } M_j \text{ are equal (where j=1, 2,..., c).}$$

The Kruskal-Wallis test statistics *H* may be computed as follows

$$H=\left[\frac{12}{n(n+1)} \sum_{j=1}^{c} \frac{T_j^2}{n_j} \right] -3(n+1)$$

where

n is the total number of observations i.e. $n=n_1+n_2+...+n_c$

or n=173+173+...173=2249

n_j is the sum of observations in the jth sample; j=1,2,...,c

n_j=173, j=1,2,...,13 (n_j is constant in this case i.e. 173)

T_j is the sum of ranks assigned to the jth sample.

T_j^2 is the square of the sum of the ranks assigned to the jth sample

The test statistic H is approximated by a chi-square, with c-1 degrees of freedom, as the sample size gets larger (that is, greater than 5). The decision rule is to reject the null hypothesis if the computed H value exceeds the upper tail value of $x^2_{U(c-1)}$, and not to reject the null hypothesis if H is less than or equal to the critical x^2 value (Berenson and Levine 1996).

Reject H_0 if $H > \chi^2_{u(c-1)}$;

Otherwise, do not reject

Dunn's Procedure for Multiple Comparison of Mean Ranks

As a follow-up to the Kruskal-Wallis rank test, a post-hoc multiple comparison procedure is proposed by O.J. Dunn (Berenson and Levine 1996). That is, if we reject the null, which means medians of all the fresh pork attributes are not equal and there is a significant difference among them, the next step is to simultaneously compare all possible pairs of the attributes to determine which ones differ from the other, using the combined rank data obtained for the Kruskal-Wallis test.

If there are c groups, the possible pair-wise caparisons to be made are $c(c-1)/2$. As we have 13 attributes or groups the possible pair-wise comparisons are 13(13-1)/2=78. First of all, the average rank $\overline{R_j}$ is obtained for each of the j groups.

$$\overline{R_j} = \frac{T_j}{n_j} \quad (\text{where } j=1,2...c=13)$$

We then compute the differences $\overline{R}_j - \overline{R}_{j'}$ (where $j \neq j'$) among all *c(c-1)/2* pairs of mean ranks. n_j is constant (173) for each group, but T_j changes from group to group. For Dunn's procedure the critical range is

$$\text{critical range} = Z_U \sqrt{\frac{n(n+1)}{12}\left(\frac{1}{n_j} + \frac{1}{n_{j'}}\right)}$$

where

n is the total number of observations over the combined groups = 2249

n_j and $n_{j'}$ are the number of observations in groups j and j' respectively

$(n_j = n_{j'} = 173)$

Z_U is the critical value from the standard normal distribution containing an area of $\alpha/[c(c-1)]$ in the upper tail, where α is the overall level of significance.

Finally, the differences in each of the pairs of mean ranks are compared against the critical range (or against the corresponding critical range if the sample sizes differ). A specific pair of groups will be declared significantly different if the absolute difference in their mean ranks exceeds the critical range.

Estimation:

SPSS 9.0, the statistical computer software, is used for these tests. The empirical results show that the null hypothesis—the importance of 13 selected fresh pork attributes being identical—is rejected at a 0.01 level of significance, as shown in Table 3.2. This indicates that the respondents do differentiate the importance of fresh pork attributes. In other words, there is evidence of a significant difference among the importance of the selected fresh pork attributes.

The next step is multiple comparisons, that is, simultaneously comparing all of the possible pairs of the mean ranks of the attributes to determine which ones differ from the other, using Dunn's procedure. The total number of possible pairs is 78. The absolute differences between the corresponding mean ranks and the critical range are calculated using Excel. The critical range found is 267.42. The absolute differences between mean ranks greater than the critical range are 53, indicating that there are 53 pairs of attributes (out of 78) that are significantly different from one another. The rest of the 25 pairs are not significantly different from one another.

The absolute difference between mean rank of free from chemicals and freshness is given by

$$\left|\overline{R}_1 - \overline{R}_4\right| = \left|1323.28 - 1942.27\right| = 618.99$$

As 618.99>267.42, we conclude that there is a significant difference between the importance of the attributes of free from chemicals and freshness. Similarly, if we compare mean ranks of the vacuum-packed pork and knowing that pork comes from the United States, we get

$$\left|\overline{R}_{10} - \overline{R}_{13}\right| = \left|580.42 - 788.55\right| = 208.13$$

This time because the absolute difference is less than the critical value (208.3 < 267.42), we conclude that there is no significant difference between the importance of these two fresh pork attributes.

Results:

The test results are presented in Table 3.2. The Kruskal-Wallis test rejects the null hypothesis that the importance rankings of the 13 pork attributes are identical. This

test indicates that Asian-origin consumers do differentiate between the importance of the pork attributes.

An order of importance for the pork attributes is derived following Dunn's procedure and is presented in Table 3.2. The multiple comparisons reveal four categories of order of importance for the specified pork attributes. Individual attributes in the same category are equally important to the surveyed Asian consumers: Freshness is the most important attribute they consider when purchasing pork. Attributes such as colour of meat, lack of fat, and the whiteness of fat are equally important among Asian consumers and comprise the second most important group of pork attributes. Their importance is not significantly different from one another, but significantly lower from the first group, freshness. The group that is third in importance includes the price of pork, freedom from chemicals, and USDA labelled. Knowing that pork comes from the United States, customized pork cuts, the variety of pork cuts, packaged pork, vacuum-packed pork and seasoned and prepared pork are in the least important group of attributes.

The Conceptual and Empirical Model

To model consumer preferences, a theoretical framework based on Lancaster's view of the demand for attributes is used. Goods are not viewed as the direct objects of utility; rather it is the attributes of the goods from which utility is derived (Lancaster 1991). In this study, a consumer's utility function associated with the purchase of pork is postulated in terms of importance ratings for selected pork attributes and it is hypothesised that these are determined by a vector (X) of the consumer's socioeconomic and demographic factors. The utility function (U) is not observable, but is assumed to reflect the observed vector of preference ratings, R (where R=0, 1, 2..., j). The vector R is comprised of the responses of each survey participant (the grocery shopper for the household in this study) and this is expressed as an ordinal ranking based on his/her individual utility function. To assess the determinants of importance rankings of pork

attributes for Asian-origin consumers, an ordered-probit model (Maddala 1983, p 46-49) is specified as:

$$U = \beta X + \varepsilon,\ \varepsilon \sim N(0,1) \tag{3.1}$$

and

$$\begin{aligned} R &= 0 \text{ if } U \le 0 \\ &= 1 \text{ if } 0 < U \le \mu_1 \\ &= 2 \text{ if } \mu_1 < U \le \mu_2 \\ &\vdots \\ &= j \text{ if } U > \mu_{j-1} \end{aligned} \tag{3.2}$$

where μ_j's are the threshold variables or cut-off points, which provide the rating of alternatives, and ε is the error term. The cut-off points vary with individuals. Individuals with similar tastes and backgrounds are expected to have similar cut-off points. Hence, from the central limit theorem the threshold level is assumed to be normally distributed. Since the μ_j's free parameters, there is no significance to the unit distance between the set of observed values of U since the μ_j's merely provide the ranking.

The probability of the consumer choosing a specific ranking is given as

$$\begin{aligned} p(R_i = 0) &= \Phi(-\beta X) \\ p(R_i = 1) &= \Phi(\mu_1 - \beta X) - \Phi(-\beta X) \\ p(R_i = 2) &= \Phi(\mu_2 - \beta X) - \Phi(\mu_1 - \beta X) \\ &\vdots \\ p(R_i = j) &= 1 - \Phi(\mu_{j-1} - \beta X) \end{aligned} \tag{3.3}$$

where $\Phi(\cdot)$ is the cumulative probability function of a normal distribution for the range of consumers' utility. The log-likelihood function is:

$$\ln L = \sum_i \ln L_i = \sum_i \ln P(R_i = j). \quad (3.4)$$

Several ordered probit models were assessed with somewhat different specifications of the independent variables, because of problems of collinearity among specified independent variables. Based on *a priori* considerations in addition to trial and error, a set of variables was chosen as defined in Table 3.3. The specified socioeconomic and demographic characteristics include: age, gender, number of years living in the United States, ethnic background, education, employment status, and whether or not the respondent prepares most of the meals in the household. All explanatory variables are expressed as binary variables—0 for nonoccurrence and 1 for occurrence—with the exception of the number of years that the respondent has been living in the United States and the size of the household, both of which are continuous variables. The variables age, income, and education are grouped into three categories as indicated in Table 3.3.

Estimation

Separate models were estimated for all 7 selected fresh pork attributes using the ordered probit model. One category from age, income, and education characteristics is dropped, as these characteristics are dummy variables and the inclusion of all three categories would result in singularity problems. Because the sample is store-based, each stratum (specific type of store) is allowed to have its own set of cutoff values. Consequently, 16 threshold coefficients were estimated. Statistically significant results of the ordered probit models of selected pork attributes are reported in Table 3.4.

A log-likelihood test was applied to assess the overall significance of the various independent variables in explaining the variations in the importance rankings (Table 3.4). A log-likelihood test using $\chi^2_{157,5\%}$ with a critical value of 26.296 indicated rejection of the null hypothesis of the test, $\beta = 0$ (a vector of the coefficients of the consumers' socioeconomic and demographic factors) at a 95% confidence level in the equations for freedom from chemicals, the USDA label, low in fat, freshness, color of meat, whiteness

of fat, and price. That is, the socioeconomic and demographic variables are relevant in explaining variations in Asian consumer importance rankings for these important attributes. This would suggest that Asian-origin consumers couldn't be treated as a homogenous group in pork marketing. However, this test did not reject the null hypothesis, $\beta = 0$, at the 95% confidence level in the equations for variety of pork cuts, seasoned and prepared pork, packaged cuts, vacuum-packaged pork, customized pork cuts, and knowing that the pork is from the United States. This implies that the socioeconomic and demographic variables are not relevant in explaining variations in Asian-origin consumers' importance rankings for these attributes which, as noted previously, were found to be of least importance to Asian-origin consumers.

Table 3.5 presents the specification test results, using estimates of the threshold variables. The threshold variables are interpreted as the numerical linkages between the utility function of respondents and the preference ratings for pork attributes. According to Maddala (1983), threshold coefficients should exhibit the relationship $\mu_{1j} \leq \mu_{2j} \leq ... \leq \mu_{j-1,j}$, and must be positive. Failure to exhibit these conditions would imply specification error in the model. All estimated threshold coefficients were positive and properly ordered. All threshold coefficients were statistically significant at the 99% confidence level except for μ_{11} in the estimation of the equations for the attributes of freshness and whiteness of fat. The results imply that that there is no misspecification error in the ordered probit model. Highly significant, positive μ estimates indicate that the categories in the response variable are indeed ordered.

Estimated coefficients are tested using t-test statistics. A positive sign on the statistically significant parameter estimates indicates the likelihood of the response increasing with the level or presence of x_k, holding other variables constant, and vice versa. For example, the coefficient of GENDER is significant at 95% in the equations for "low in fat" (Column 3, Table 3.4) and for "freshness" (Column 4, Table 3.4), but GENDER is not significant in the rest of the attribute equations. The significantly

positive coefficient of GENDER in the equations for "low in fat" indicates that the likelihood of "low in fat" being important is higher for a respondent who is male rather than female. The significantly negative coefficient of GENDER in the equation for freshness indicates that the likelihood of the importance of this attribute decreases for a respondent that is male rather than female. The importance rankings for other attributes are not changed with a difference in gender of the respondent.

Estimated coefficients of the large Asian store (LASIANSTORE) were positive and significant at a 95% level of confidence in the equations for freshness and price, but not significant in the rest of the attribute equations. This suggests that Asian consumers who purchase most of their fresh pork in large Asian stores value freshness more and are more price sensitive than other Asian-origin consumers. Coefficients of the ethnic origin (CHINESE) were negative and significant at a 99% level of confidence in the equations for "free from chemical residues" and "USDA label", while the estimated coefficient on CHINESE was positive and significant at a 95% level of confidence in the price attribute equation. This suggests that Chinese-origin consumers, value food safety attributes less than do the other groups of Asian-origin consumer, and that Chinese are more price sensitive than these other groups. Coefficients on the birth place (BIRTHUS) were positive and significant at a 95% level of confidence in the equations for "free from chemical residues" and "USDA label", suggesting that a typical Asian-origin consumer who was born in the United States values food safety attributes more than the other identified groups of Asian-origin consumers. The number of years that Asian-origin consumers have lived in the United States significantly affects the importance rankings for the price attribute. The negative coefficient on the numbers of years living in the United States (YEARINUS) indicates that the longer an Asian-origin consumer have lived in the United States, the more likely it is that the consumer is less price sensitive.

Coefficients for the respondents who are 34 or under (YOUNGAGE) and who are between 35-44 (MIDAGE) were positive and significant at a 99% or 95% level of confidence in the equations for "free from chemical residues" and "the USDA label". Asian-origin consumers who are 45 years or less of age value food safety attributes more

highly than do older Asian consumers. The estimated coefficient on YOUNGAGE was negative and significant at a 95% level of confidence in the price attribute equation. This indicates that Asian-origin consumers of 35 or less years of age tend to be less price sensitive than the older Asian-origin consumers. Coefficients of the respondents who are university educated (UNIVERSITY) were negative and significant at a 99% level of confidence in the equations for "low in fat", "color of meat", and "whiteness of fat". University-educated Asian-origin consumer value fresh pork attributes such as low in fat, color of meat, and whiteness of fat less than is the case for the sampled college-educated Asian-origin consumers. One interesting result that seems inconsistent with the prior expectations concerning education is that the sampled high school graduates appear to have the same preferences as college graduates.

Coefficients on the number of household members (HDSIZE), middle income group (MINCOME), and low-income group (LINCOME) were insignificant in all of the attribute equations. This suggests that household size and income were not important determinants of the importance rankings for fresh pork attributes.

Marginal Effects on the Probability of Importance Rankings

While the signs of parameter estimates and their statistical significance indicate the likelihood of the response associated with the level of significance of a particular variable, interpretation is aided by computing how much a particular variable increases or decreases the likelihood of the response. To aid in this interpretation, the marginal effect of the independent variables on the probability of importance rankings for pork attributes is calculated. For the ordered probit model, the marginal effects can be computed as (Liao 1994, p 45)

$$\frac{\partial P(R=j)}{\partial x_k} = \left[\Phi\left[\mu_{j-1} - \sum_{k=1}^{k} \beta_k x_k \right] - \Phi\left[\mu_j - \sum_{k=1}^{k} \beta_k x_k \right] \right] \beta_k \qquad (3.5)$$

where $\frac{\partial P(\cdot)}{\partial x_k}$ is the partial derivative of probability with respect to x_k and other notation is as before. All, but the variable being interpreted, are held at their mean values. The marginal effects are computed for all equations and independent variables using LIMDEP 7.0. The marginal effects for the variables that are found to be statistically significant are reported in Table 3.6. A positive marginal effect of x_k indicates that the probability of an event increases with x_k while a negative effect indicates the opposite. The marginal effects should sum to zero by canceling one another out across the response categories. Scrutiny demonstrates that it holds true for the marginal effects in Table 3.6.

The interpretation of the marginal effects is reasonably self-evident. Rank 5 represents the highest preference rating and 0 is the lowest rating. For example, the marginal effect for CHINESE on the probability of choice of particular importance rankings for "free from chemicals" shows that, if the respondent is of Chinese-origin, there is an increase of 9.38% in the probability of choosing rank 0, an increase 15.06% in the probability of choosing rank 1, an increase of 2.03% in the probability of choosing rank 2, a decrease of 9.30% in the probability of choosing rank 3, a decrease of 6.89% in the probability of choosing rank 4, and a decrease of 10.29% in the probability of choosing rank 5. Taking another example, the marginal effect with respect to USYEARS on the probability of importance rankings for the price attribute shows that, if the respondent has lived in the United States for one year longer, there is an increase of 0.29% in the probability of choosing rank 0, an increase of 0.3% in the probability of choosing rank 1, an increase of 0.19% in the probability of choosing rank 2, a decrease of 0.28% in the probability of choosing rank 3, a decrease of 0.29% in the probability of choosing rank 4, and a decrease of 0.21% in the probability of choosing rank 5.

In contrast to above results, a study by Menkhaus et. al. (1988) suggested that demographic characteristics, such as age, education, income and household size have no effect on the purchase of branded low fat, fresh beef product in San Francisco.

A study in United States by Nayga (1995) suggested that socioeconomic, demographic and geographic characteristics of consumers affect the consumption of pork. His results suggested that urban and suburban consumers consume significantly less pork compare to non-metropolitan consumers. Our study suggested similar results as the coefficients of CITY were negative for pork and most of pork cuts but not significant except for legs. Nayga (1995) also suggest that region had an effect on the consumption of pork, which was consistent with our results for provinces. However, Nayga's (1995) results suggested that Asian and Pacific Islanders were not likely to consume significantly more pork compare to whites (the coefficient is positive but not significant). While, our results suggested that the Asians were likely to consume significantly more pork compare to Canadians (the coefficient was positive and significant). Similarly, Nayga's (1995) results suggested that males were likely to consume more pork, as against females were likely to consume more pork in our case. Household size and age has a positive effect and income has no significant effect on the overall consumption of pork, which was consistent with our results. Our study suggested that consumers were likely to consume less pork in quarter 3 and the results of Nayga (1995) suggested that quarter of the year had no significant effect on the consumption of pork (though coefficient of quarter 3 was negative but not significant).

Summary

This chapter reports on a study examining the ranking of selected attributes of fresh pork by Asian-origin consumers in San Francisco, California. The study is based on a mall intercept survey of 173 pork consumers that was conducted in 1998. The non-parametric tests—Kruskal Wallis tests for independent samples and Dunn's procedure—revealed that there are four distinct groups of 'order of importance' for selected fresh pork attributes.

The sampled consumers ranked freshness as the most important attribute. The second most important category of pork attributes included colour of meat, lack of fat, and the whiteness of fat followed by price, freedom from chemicals, and the USDA label.

Knowing that pork comes from the United States, customized pork cuts, the variety of pork cuts, packaged pork, vacuum-packed pork, and seasoned and prepared pork were in the least important category of attributes. Empirical results from an ordered probit model postulated to explain respondents' rankings of attributes suggested that particular demographic and socioeconomic characteristics of Asian-origin consumers influenced the importance rankings of selected pork attributes. Chinese are less concerned about freedom from chemicals and the USDA label but more concerned about price. On the other hand, United States-born Asians and young and middle age consumers are more concerned about freedom from chemicals and the USDA label. With increasing years in the United States, Asian immigrants become less sensitive about price. Males are less concerned about freshness but the customers of the large Asian stores are more concerned about this. Young consumers are less concerned about the price and university graduates are less concerned about the lowness in fat, color of meat and whiteness of fat compared to college graduates.

Marginal effects suggested that the probability of choosing freshness as the most important variable increases by 38% if the consumer is buying pork from the large Asian stores. Similarly, the probability of choosing the USDA label as the least important attribute increases 12.6% if the respondents are Chinese. The probability of choosing freshness as the most important variable decreases by 21.3% if the respondents are male instead of female. For young people the probability of choosing freedom from chemicals as the most important variable increases by 12.3% but the probability of choosing price as the most important variable decreases by 7.4%. The findings also suggest that Asian-origin consumers should not be treated as a single homogenous niche group in marketing, since there are identifiable sub-groups of these consumers with specific attitudes and preferences.

Table 3.1. Comparison of Sample Survey and San Francisco Demographic Data

Socioeconomic and Demographic Characteristics	Categories	Representation in the Survey Sample	Representation in San Francisco Statistics
Gender	Male	43.35%	48.15%
	Female	56.65%	51.85%
Ethnic Background	Vietnamese	4.05%	3.93%
	Filipino	9.83%	27.96%
	Chinese	71.10%	51.35%
	Korean	0.57%	3.29%
	Japanese	6.94%	7.48%
	other	7.51%	5.99%
Age Category	≤24	8.67%	30.90%
	25-34	27.75%	16.96%
	35-44	30.10%	15.58%
	45-54	10.98%	11.86%
	55-64	2.98%	9.35%
	>65	19.65%	15.35%

Source: Brown (1998) and Le's (1999) San Francisco Survey

Table 3.2. The Kruskal-Wallis Test and Dunn's Procedure for Multiple Comparisons of Importance Rankings for Selected Fresh Pork Attributes

3.2a. The Kruskal-Wallis Test

H_0: the importance rankings of 13 selected fresh pork attributes are identical.
H_1: the importance rankings of 13 selected fresh pork attributes are identical.

Observed Chi-square=1074.385 and critical Chi-square=26.217 at 0.01 level of significance with 12 degree of freedom. The null is rejected.

3.2b. Dunn's Procedure

Fresh Pork Attributes	Mean Ranks for Fresh Pork Attributes	Dunn's Procedure for Multiple Comparison of *c* Sample Mean Ranks	
freshness	1942.269	A*	(1)**
color of meat	1594.381	B	(2)
low in fat	1544.642	B	(2)
whiteness of fat	1514.101	B	(2)
price of pork	1383.751	C	(3)
pork free from chemicals	1323.280	C	(3)
USDA label	1278.671	C	(3)
knowing that pork comes from USA	788.552	D	(4)
customized pork cuts	724.535	D	(4)
variety of pork cuts	706.983	D	(4)
cut and packaged pork	678.197	D	(4)
vacuum packed pork	580.422	D	(4)
seasoned and prepared pork	565.217	D	(4)

*Asian-origin consumer importance rankings on the attributes in the same category (A, B, C, or D) are not statistically different, while Asian-origin consumer importance rankings on the attributes in the different categories (A, B, C, or D) are statistically different.
**The numbers in the parenthesis are the order of importance ranks for the fresh pork attributes.

Table 3.3. Variable Codes and Statistics for the Survey Data.

Independent Variables	Definition & Codes	Mean	Standard Deviations
SASIANSTORE	small Asian store=1, otherwise=0;	0.231	0.423
LASIANSTORE	large Asian supermarket=1, otherwise=0;	0.168	0.375
ASUPERMKT	American style supermarkets=1, otherwise=0;	0.468	0.500
SSTORE	meat specialty store=1, otherwise=0.	0.133	0.341
GENDER	Male respondent =1; female =0	0.434	0.497
MEALMAKER	If the respondent is the main meal maker, yes=1; no=0	0.618	0.487
CHINESE	Chinese=1, otherwise=0.	0.711	0.455
USBIRTH	Born in U.S. =1; other=0	0.243	0.443
USYEARS	Numbers of Year Lived in the Unite States	21.625	16.498
HDSIZE	Number of family members in the household	2.983	1.395
LINCOME	under $29,999=1, otherwise=0;	0.295	0.457
MINCOME	$30,000-44,999=1, otherwise=0;	0.277	0.449
HINCOME	$45,000 and over=1, otherwise=0.	0.428	0.496
YOUNGAGE	Under 34=1, otherwise=0;	0.364	0.483
MIDAGE	Between 35-44=1, otherwise=0;	0.301	0.460
OLDAGE	45 and over=1, otherwise=0.	0.335	0.473
FULLEMPL	full time employment=1, otherwise=0.	0.572	0.496
HIGHSCHOOL	up to high school/technical school=1, otherwise=0;	0.364	0.483
COLLEGE	up to college=1, otherwise=0;	0.335	0.473
UNIVERSITY	University=1, otherwise=0.	0.301	0.460

Table 3.4. The Estimates of the Ordered Probit Model on the Importance Rankings for the Selected Fresh Pork Attributes

Explanatory Variables	Importance Rankings for Pork Attributes /a						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	1.531**/b	1.963**	1.963**	1.742**	1.684*	1.455*	1.228*
GENDER	-0.070	-0.286	0.510*	-0.543*	0.387	0.498	0.261
MEALMAKER	0.264	0.060	0.272	-0.246	0.273	0.299	-0.088
SASIANSTORE	-0.100	-0.224	-0.480	0.190	-0.437	-0.482	-0.119
LASIANSTORE	-0.093	-0.507	-0.131	1.074*	-0.116	0.212	0.801*
ASUPERMKT	-0.176	-0.402	-0.101	0.406	-0.070	0.149	0.520
CHINESE	-0.740**	-0.857**	0.113	-0.279	-0.061	0.065	0.415*
USBIRTH	0.665*	0.803**	-0.577	-0.305	-0.426	-0.620	-0.146
USYEARS	-0.003	0.006	0.001	0.012	0.002	0.007	-0.021*
HDSIZE	0.065	0.036	-0.113	0.122	-0.058	-0.110	-0.009
LINCOME	-0.048	-0.068	0.059	0.385	0.220	-0.036	0.260
MINCOME	-0.254	-0.322	0.325	0.179	0.474	0.350	0.192
YOUNGAGE	0.840**	0.789*	-0.305	-0.112	-0.034	-0.051	-0.704*
MIDAGE	0.836**	0.881**	-0.003	-0.260	0.019	0.008	-0.451
FULLEMPL	-0.241	-0.210	-0.075	0.092	-0.050	-0.086	0.123
HIGHSCHOOL	-0.258	-0.478	-0.034	0.373	-0.021	0.116	0.484
UNIVERSITY	-0.171	-0.289	-0.605**	0.303	-0.618**	-0.628**	0.161
Model chi-squares	60.42**	78.60**	53.62**	37.71**	45.24**	49.13**	46.82**

a (1) Free from chemical residues, (2) USDA Label, (3) Low in Fat, (4) Freshness, (5) Color of Meat, (6) Whiteness of Fat, and (7) Price of Pork.
b. * at the 0.05 level of significance, and ** at the 0.01 level.

Table 3.5. Major Statistical Properties of the Ordered Probit Models

Coefficients of the Thresholds Variables	Importance Rankings for Pork Attributes/a						
	1	2	3	4	5	6	7
μ_{11}	0.998**	1.028**	0.779**	0.857*	0.351	0.278	0.334**
μ_{21}	2.055**	2.091**	1.135**	1.193**	0.602**	1.344**	1.327**
μ_{31}	2.291**	2.304**	1.937**	1.626**	1.619**	1.806**	2.562**
μ_{41}	2.567**	2.558**	3.164**	2.903**	2.681**	2.887**	2.980**
μ_{12}	1.076**	1.010**	0.589**	0.482	0.131	0.459*	0.669**
μ_{22}	1.920**	1.733**	1.526**	0.726*	1.218**	1.359**	1.368**
μ_{32}	2.636**	2.480**	2.246**	1.838**	2.103**	2.095**	2.174**
μ_{42}	2.929**	2.869**	3.393**	2.719**	3.018**	3.366**	2.971**
μ_{13}	0.720**	0.874**	0.296**	0.310	0.364**	0.249**	0.600**
μ_{23}	1.820**	1.732**	0.972**	0.877**	0.815**	0.838**	1.517**
μ_{33}	2.547**	2.443**	1.792**	1.684**	1.809**	1.737**	2.456**
μ_{43}	3.224**	3.457**	2.437**	2.726**	2.535**	2.361**	2.870**
μ_{14}	1.056**	1.092**	0.631**	0.382**	0.684**	0.480**	0.783**
μ_{24}	1.696**	2.134**	1.219**	0.912**	1.097**	1.307**	1.414**
μ_{34}	2.381**	2.524**	2.279**	1.471**	2.135**	2.177**	2.530**
μ_{44}	2.705**	2.807**	3.243**	2.252**	3.231**	2.851**	3.706**

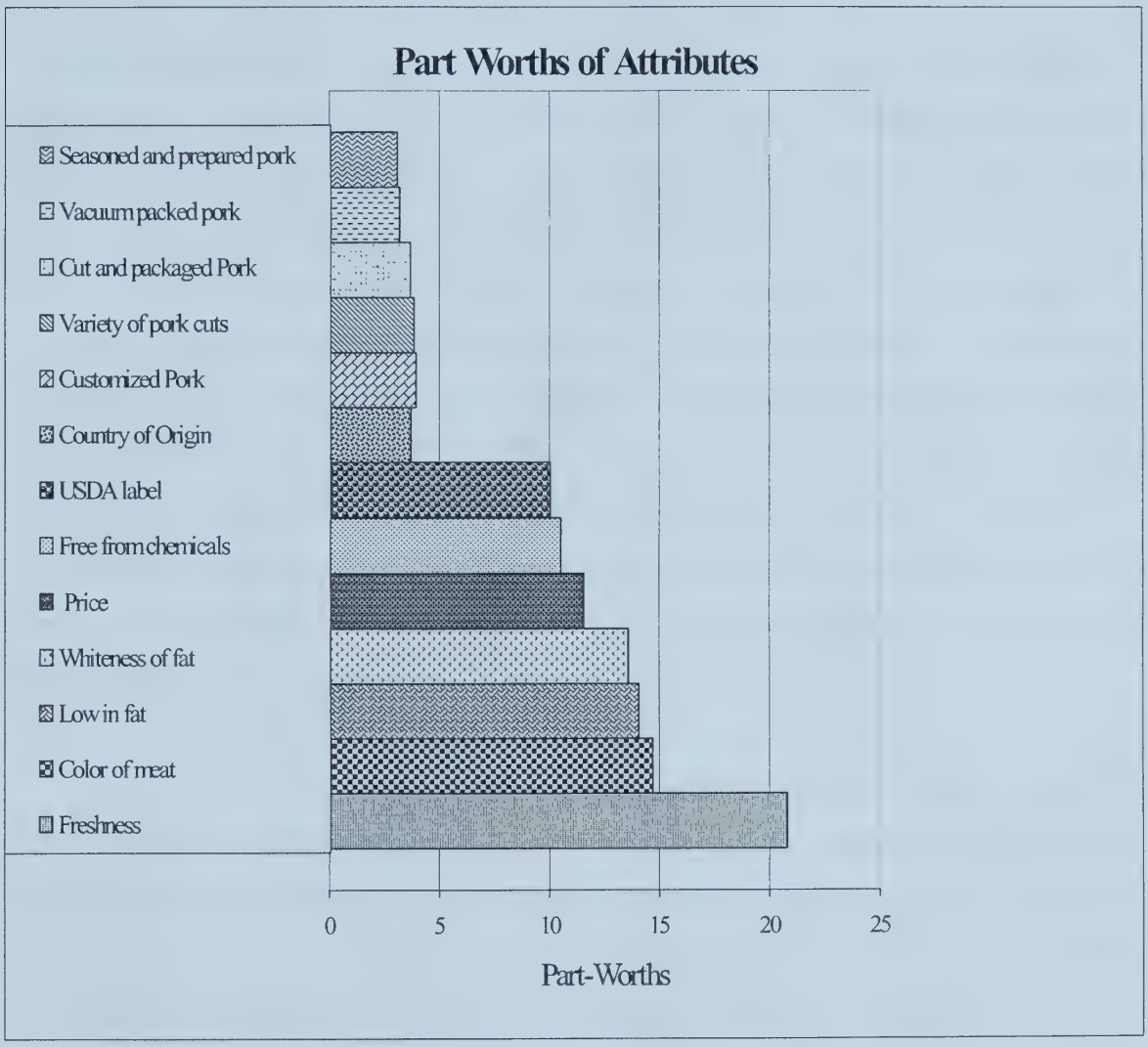
a (1) Free from chemical residues, (2) USDA Label, (3) Low in Fat, (4) Freshness, (5) Color of Meat, (6) Whiteness of Fat, and (7) Price of Pork.
b. *at the 0.05 level of significance and ** at the 0.01 level.

Table 3.6. The Marginal Effects of Selected Factors on the Probabilities of Importance Rankings for Pork Attributes

Attributes	Marginal Effect on the Probabilities of the Importance Rankings for Fresh Pork Attributes*					
	Prob(j=0)	*Prob(j=1)*	*Prob(j=2)*	*Prob(j=3)*	*Prob(j=4)*	*Prob(j=5)*
(1) Free from Chemical Residues						
CHINESE	0.0938	0.1506	0.0203	-0.093	-0.0689	-0.1029
USBORN	-0.0899	-0.1443	-0.0195	0.0891	0.066	0.0986
YOUNGAGE	-0.1118	-0.1795	-0.0242	0.1109	0.0821	0.1226
(2) USDA Label						
CHINESE	0.1257	0.1929	-0.0005	-0.1136	-0.1008	-0.1036
USBORN	-0.113	-0.1734	0.0005	0.1022	0.0906	0.0931
YOUNGAGE	-0.1173	-0.1799	0.0005	0.106	0.094	0.0967
MIDAGE	-0.1302	-0.1999	0.0006	0.1178	0.1044	0.1074
(3) Low in Fat						
GENDER	-0.0572	-0.055	-0.0577	0.0057	0.0925	0.0717
UNIVERSITY	0.0758	0.073	0.0765	-0.0075	-0.1227	-0.095
(4) Freshness						
GENDER	0.0054	0.0093	0.0345	0.1034	0.0599	-0.2125
LASIANSTORE	-0.01	-0.0171	-0.0631	-0.1895	-0.1097	0.3894
(5) Color of Meat						
UNIVERSITY	0.0771	0.055	0.0873	0.0167	-0.1197	-0.1164
(6) Whiteness of Fat						
UNIVERSITY	0.0915	0.0533	0.0863	-0.0108	-0.1141	-0.1061
(12) Price						
LASIANSTORE	-0.1359	-0.1409	-0.0897	0.1306	0.1367	0.0992
CHINESE	-0.0571	-0.0592	-0.0377	0.0548	0.0574	0.0417
USYEARS	0.0029	0.003	0.0019	-0.0028	-0.0029	-0.0021
YOUNGAGE	0.1009	0.1045	0.0666	-0.0969	-0.1015	-0.0736

* 5 represents highest preference rating and 0 lowest rating

Figure 3.1. Asian-Origin Consumer Importance Rankings for 13 Selected Fresh Pork Attributes



Chapter 4

Summary and Conclusions

The ethnic mix in North America is changing and Asians are emerging as a significant ethnic group (Statistics Canada, U.S. Census Bureau). Ethnicity has become a very important variable in determining food demand (Solomon et al 1999). Many studies have suggested that ethnicity has potential effects on food demand (Hui et al 1995, Chen 2000). Because the growth in Asian immigrants is recent, their food demand and preferences may be well known to the markets. Research is needed on such ethnic communities that are fast-growing, large enough to be viable, and whose food demands are potentially less well-known to food producers, processors, and distributors. Pork is an important component of Asian food and is primarily consumed as fresh meat. Unfortunately, there have been very few studies examining Asian preferences for fresh pork in North America. This thesis looked into the issue using both American and Canadian data.

The results of the Canadian data suggested that Asians are more likely to purchase pork compared to the other ethnic groups (Table 2.5a). Asians, as compared to Canadian-born, are more likely to purchase various pork parts except legs. Compare to other ethnic groups (USNWEURP and SEEUROPE) Asians are more likely to purchase all parts of pork, except loins and offal. Even though Asians are more likely to purchase bellies when compared to other ethnic groups, their probability of purchasing bellies decreases by 0.0138 with one unit increase in their number of immigration years. However, the consumption of all other pork parts seems unaffected by immigration years. Other factors revealed to be important in the determination of a consumer's pork purchase decision included seasonal effect (time of the year), province, age, gender, education, and household size. The results suggest that Asians have specific preferences in purchasing pork and could be considered as a possible potential niche market for pork.

Considering Asians have similar tastes, preferences, and consumption patterns, Asian ethnic markets in the United States could also be considered similar niche markets for pork. Results in chapter 3 are more reliable as they are based on a large data set of Family Food Expenditure Survey (Statistics Canada). These results suggest that Asians are morel likely to consume pork than any other ethnic group in the model. This result provided an important base for chapter 3. Thus, in chapter 3 we had assumed that Asians consume significant amounts of pork and their ethnic market in San Francisco could be considered a potential niche for pork and was therefore studied in more details.

The non-parametric test based on San Francisco data (Chapter 3) revealed that there are four distinct groups of 'order of importance' for selected fresh pork attributes. The sampled consumers ranked freshness as the most important attribute. The second most important category of pork attribute included the color of the meat, its lack of fat, and the whiteness of the fat followed by the price of pork, its freedom from chemicals, and whether or not it is USDA-labeled. Knowing that pork comes from the United States, customized pork cuts, the variety of pork cuts, packaged pork, vacuum-packed pork, and seasoned and prepared pork were in the least important categories of attributes.

The empirical results from the ordered probit model suggested that Asian-origin consumers' demographic and socio-economic characteristics influenced their ranking of the importance of certain pork attributes. Results suggested that compared to females, males are significantly less conscious about freshness. Another important result suggested that Chinese were not concerned about two fresh pork attributes i.e. 'free from chemicals' and 'USDA label'. However, respondents born in United States were significantly concerned about 'free from chemicals' and 'USDA label'. The importance of price attribute decreased with increasing years of immigration and food safety attributes such as "free from chemical residues" were valued more by United States-born and younger Asian-origin Americans.

Comparison

Though both chapter 2 and 3 are on pork, they achieved different objectives. Chapter 2 was based on FFES data and focused on the purchase decision of pork and pork parts by the Canadian consumers. The objective of the study was to find out whether or not Asians consumed pork differently from the rest of the population. The results suggested that Asians were more likely to purchase pork compared to the rest of the population. As such Asians could be considered as a potential niche market for pork suppliers. Chapter 2 formed basis for chapter 3, which considered Asian ethnic market in more details. It focused on how Asian consumers in San Francisco valued selected fresh pork attributes.

It is particularly interesting to note that 'immigration years' was a variable common to both studies. The results suggested that 'immigration year' not only affected purchasing decision of pork but also affected the selection of fresh pork attributes. Increasing immigration years of Asians in Canada seemed to lower Asians' likelihood of purchasing bellies (Chapter 2). On the other hand increasing years of stay of Asians in United States seemed to decrease price consciousness (Chapter 3). These results suggested that Asian may change their purchase behavior after staying in Canada or United States for a little while.

Marketing Implications:

Marketing efforts could be directed at individuals who have a higher probability of purchasing pork. The results of the dichotomous probit models are useful in identifying socioeconomic and demographic groups inclined to purchase more pork or varieties of pork. Keeping in view the marginal effects of the models, several marketing implications can be drawn. It is indicated that Asian consumers purchase significantly more pork compared to the Canadian-born. Except with regards to legs, Asians consume every part of pork including bellies in significantly larger amounts when compared to Canadian-born. However, with one unit increase in immigration years the probability of

purchasing bellies decreases by 13.8 percent. Based on these results Asians could be considered as a significant ethnic group for the purchase of pork though not homogeneous, and therefore a possible niche market for pork in Canada. Considering that Asians have significantly higher probability of purchasing pork and different cuts of pork compare to others, Asians ethnic market in San Francisco, California could also be considered as a niche market for pork.

Similarly, it might be possible to generalize age, education, household size, etc. affects for North America, instead of Canada only. Table 2.5 indicates that household size has a quite large and highly significant effect on the consumption of pork; meaning that bulk marketing (in large volume or packing) of pork is possible for large households. Similarly, females, Southeastern Europeans, and older people could also be target consumers for pork and offal. For offal and hocks marketing, the best choice would be Quebec consumers, Southeastern Europeans immigrants, Asians, and older-age consumers. For shoulders the best choice would be old-age consumers, Southeastern Europeans, Asians, large households, and consumers receiving social assistance (low-income consumers). On the other hand, high-income consumers seem to consume more loins and bellies, which means if these consumers are assumed to be less price sensitive then higher prices could be received for loins and bellies. Similarly, several other implications can be drawn; keeping the results presented in tables 2.5 to 2.11 in view.

The results of the ordered probit model may be useful in helping determine effective marketing strategies, targeted to Asian-origin consumers. For example, Chinese-origin respondents were found to be much more price sensitive, suggesting that efforts to reduce production and marketing costs of pork could be of particular importance in marketing pork to the Chinese-origin segment of the Asian pork market. Secondly, customers of large Asian stores are significantly more concerned about price compared to others. Production and marketing costs could also be reduced by keeping in view the suggested results of low concern in Chinese about "freedom from chemicals" and the USDA label, if pork marketing is possible without these attributes. Along with other implications the above results also suggested that Asian ethnic consumers are not a

single homogenous niche market for pork. Instead, Asian ethnic consumers are heterogeneous niche market consisting of identifiable sub-groups of consumers with specific preferences.

Limitations:

It should be acknowledged that the results derived in chapter 2 are based on the FFES 1992 data, even though data from the 1996 survey were available. The reason for choosing 1992 data was due to the fact that an important variable for this study, 'immigration years' was only present in the 1992 data. As the 1992 data may not represent the true picture of present-day Canada, care should be therefore exercised when extending these results to draw inferences on a national level today. Another limitation of the study is ethnic variables: ethnic variables are not an exact representation of the given title. The variable 'Asian', for instance, not only includes Asian countries but also countries in Oceania. However, immigration from countries in Oceania has always been very low compared to Asian countries (Statistics Canada). Another limitation of the study is that it ignores some of the explanatory variables important for the consumption of pork. Variables such as religion and vegetarian/non-vegetarian could significantly affect a decision to consume pork, which could not be explained by the variables present in this model. Finally, a logical extension of this work would also give further attention to alternative demographic and socioeconomic factors that might be relevant to pork consumption but that are not included in this model. For instance, variables related to health and religious believes of the respondent.

There are several limitations to the study based on the survey conducted in San Francisco, California as well (Chapter 3). First, the sample selected was not randomly collected and was based on the mall intercept method at particular stores only. The survey included only those respondents who had purchased pork, but a more unbiased picture of consumers would have been provided if the sample had also included consumers who had not purchased but consumed pork. Problems associated with non-random data may include the questionable validity of some of the statistics (such as

coefficients of one or more independent variables) used to analyze the data, along with the fact that test statistics such as Chi-square tests also call for random variables (Jobson 1992). Ordered probit models were estimated only for seven out of thirteen most important fresh pork attributes. However, it does not mean that the rest of the attributes are not important at all. A clearer picture associating consumer characteristics to fresh pork attributes would have been possible if all of the models had been estimated.

Several other meat attributes considered by other studies are not included in the questionnaire at all: e.g. water content, taste and flavor, low sodium and cholesterol content, etc. These attributes are considered in several other studies (Hui et al 1995, for instance) and are found to be significantly associated with several consumer characteristics. Though perfect models for demand for fresh pork are not be possible, several other variables such as cleanliness and nutritional information are also included in such surveys for a more vivid picture of the association between pork attributes and consumer characteristics. However, more variables were not included in the survey to keep the survey short enough to be participated in by all respondents.

Finally, the total population of Asian and Pacific Islanders in San Francisco in 1998 was about 260,000, thus the survey represents less than 0.07% (173) of the total population. The sample size is however, determined by factors such as number of groups and subgroups, required level of accuracy, cost of the sample, and variability of the population. Sudman (1976) suggested an ad hoc method or rule of thumb for the sample size, which suggests a sample size of at least 100 for each group—Asians for instance—and a minimum sample size of at least 20 for each subgroup—Chinese for instance. Minimum sample size of 20 may not have been achieved for all subgroups (for instance Filipino, Korean and Japanese) in the San Francisco data. However, if one of the subgroups of the population is relatively small percentage of the population (Korean for instance), then it is sensible to use disproportionate sampling (Aaker et al 1998). This suggests that the sample size of 173 is justifiable on the basic grounds for sample size.

Thus even though there are some limitations to both studies, we have achieved our basic objectives. In chapter 2 we have figured out that Asian consumers were different in terms of their pork consumption from the rest of the population. Asians were likely to purchase more pork than any other ethnic group. Asians could be considered as a potential niche market for pork. Chapter 3 identified fresh pork attributes such as freshness, color of meat, low in fat, whiteness of fat and price that were valued most by the Asian-origin consumers. Socioeconomic variables such as gender, Chinese, immigration years, education and age, which affected fresh pork attributes were also identified in chapter 3. Marketing implications would include targeting consumers who have higher probability for purchasing pork or parts of pork such as, Asian, Southeastern European and females. Producers should focus on attributes such as freshness, color of meat, low in fat, whiteness of fat and price, while marketing pork to Asian ethnic markets.

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Appendix 1: Ranking Survey

Store type: _____ Date:_____

Purchase pork: Y N Time:_____

Gender: M F Location:_____

1. Are you the person that normally does the grocery shopping? Please check. ____Yes ___No
2. Are you the person who prepares the main meals? Please check. ____Yes ___No

3. Please evaluate each of the following PORK characteristics, in terms of how important the characteristic is to you personally, by circling a number.

Characteristics							
Free from chemical residue (e.g. residue left from the use of antibiotics)	Not Important	1	2	3	4	5	Extremely Important
USDA Label	Not Important	1	2	3	4	5	Extremely Important
Low in fat (Leanness of pork)	Not Important	1	2	3	4	5	Extremely Important
Freshness	Not Important	1	2	3	4	5	Extremely Important
Color of meat	Not Important	1	2	3	4	5	Extremely Important
Whiteness of fat	Not Important	1	2	3	4	5	Extremely Important
Variety of pork cuts (loins, shoulder, legs, chops, ground etc)	Not Important	1	2	3	4	5	Extremely Important
Seasoned and prepared pork (Ready - to - Cook Pork)	Not Important	1	2	3	4	5	Extremely Important
Cut and packaged pork (pork is wrapped in plastic on a styrofoam tray)	Not Important	1	2	3	4	5	Extremely Important
Vacuum packaged pork	Not Important	1	2	3	4	5	Extremely Important
Customized pork cuts (pork cut to your specifications)	Not Important	1	2	3	4	5	Extremely Important
Price of pork	Not Important	1	2	3	4	5	Extremely Important
Place of purchase (type of store)	Not Important	1	2	3	4	5	Extremely Important
Knowing that pork comes from the United States	Not Important	1	2	3	4	5	Extremely Important

4. Please rank the 6 characteristics of pork, in order of importance when purchasing pork. Rank from 1 to 6.

(1- being the most important and 6 - the least important) No repeat number- use only one number once.

Freshness	Appearance: Color of meat, and whiteness of fat	Price	Food Safety: Chemical residue	Country of Origin: Whether pork comes from the United States	Convenience (Easy to Prepare)

5. What is your overall opinion of the **QUALITY** of fresh pork in California? Please circle a number.

Poor 1 2 3 4 5 Excellent

6. Please mark **YES** or **NO** or **I Don't Know** to the following questions.

I buy fresh pork more than once a week.	YES	NO	I Don't Know
I always look at the package expiration date when I buy pork.	YES	NO	I Don't Know
I only buy the leanest pork.	YES	NO	I Don't Know
I use advertisements to compare pork prices, before making a pork purchase.	YES	NO	I Don't Know

7. Where do you buy MOST of your fresh pork? Please check one.

___ Small Asian Grocery store ___ American Style Supermarket ___ Others
___ Large Asian Supermarket ___ Meat Specialty Store (butcher shop)

8. What is your ethnic background? Please check one.

____Vietnamese ____Chinese ____Japanese
____Filipino ____Korean ____Other

9. Were you born in the United States? Please circle. YES NO

10. Number of years living in the United States? _____

11. Size of household including yourself? Please check one.

__1 __2 __3 __4 __5 __6 __7 __8 or more.

12. What is your approximate net family income from all sources before tax in 1997? Please check one.

____Less than $15,000
____$15,000 - $29,999
____$30,000 - $44,999
____$45,000 - $59,999
____$60,000 - $74,999
____$75,000 - $99,999
____$100,000 and over

13. Your age category?

____Under 24 years
____25 - 34 years
____35 - 44 years
____45 - 54 years
____55 - 64 years
____65 and over

14. Which is your current job status? Please check one

___ Student ___Employed full time ___Unemployed ___ Other
___Retired ___Employed part time ___ Full time home maker

15. What is the highest level of education that you have completed? Please check one.

___Elementary ___High school ___ College
___Junior High ___Technical school ___ University

16. Are there any pork products or changes in the pork products that you would like to see